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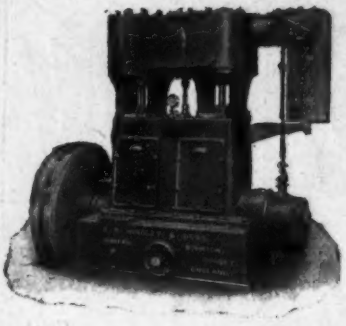

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THE

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FUEL ECONOMY AND CONTROL.

ONE of the most pressing questions of our time is the economical utilisation of our national fuel resources, which, though it has been a matter for discussion and speculation for a good many years, has only attracted public attention under the stimulus of war conditions. It is, however, now generally recognised that the industrial and commercial prosperity of this country primarily depends on its fuel resources, and the method of disposal of the latter is attracting widespread attention in scientific and industrial circles.

The paper recently read by Mr. J. A. Robertson before the Municipal Electrical Association dealt with one phase of this question, *i.e.*, the possible saving in fuel by its conversion to, and use in the form of, electrical energy; but this is only one of the many aspects of the problem of fuel economy, the treatment of which depends so largely on the point of view of the individual.

It appears to us, however, that there is only one broad view of the whole matter, on which our future policy must depend—that we should aim at the *conservation of fuel values* in the national interest, rather than in the interest of the individual. The latter is unlikely voluntarily to adopt any scheme with the above object in view which involves sacrifice on his part, and it seems fairly evident that no satisfactory solution of the problem of utilising our fuel resources to the best advantage will be arrived at without some measure of public control.

We may, for instance, consider Mr. Robertson's proposals in conjunction with the coal transport reorganisation scheme put forward by the Coal Controller, and referred to elsewhere in this issue. Both proposals are practically bound up with the transport question, for while Mr. Robertson would save the use, and therefore transport, of 30 million tons of coal for domestic and factory use, by "doing it electrically," in the future, the coal transport reorganisation scheme aims at the saving of some 700 million ton-miles during the next year in coal transport by re-arranging the producers and consumers of 40 million tons of fuel. Seeing that both schemes are broadly conceived, it is probable that a *pro rata* saving in transport, *i.e.*, over 500 million ton-miles annually, may result when Mr. Robertson's proposals materialise.

In passing, we may refer to the recommendations of the Controller of Coal Mines, published in our last issue, in which factory and domestic users are urged to supersede raw fuel by electricity, and assistance is promised in attaining the object in view, particularly by the interconnection of supply undertakings, where the saving of coal would warrant the necessary expenditure on plant.

It seems necessary to distinguish clearly between what can be accomplished now and what may be accomplished in the future; what we do now may or may not materially influence our course of conduct later on, when, as we may reasonably assume will be the case, the fuel utilisation problem of the country is identified with a definite national policy. Mr. Robertson, though claiming an open mind on the subject of coal carbonisation and by-product re-

covery in connection with electricity production, decides on present knowledge that the moment is inopportune for realising such schemes, mainly because it might result in a fractional increase in the cost of electricity; yet we note that he would have coal mining methods reorganised under Government control, so that the national wealth will not be wasted underground in the interests of mine shareholders and profit-making middlemen.

Even if the carbonisation of coal used in electricity works increased the amount of fuel required in the proportion of, roughly, 3: 2, as shown by Mr. Robertson, this would inappreciably increase our total home consumption of fuel, while it would, on the other hand, release valuable products which have in the past been largely imported from abroad. The modern power station combines two extremes—the turbine room, where scientific control has been reduced to a fine art, and the boiler-house, where such control is to a large extent abortive owing to the type of fuel employed, a difficulty which could be got over by gas-firing.

It is unthinkable that by-product processes will stand still, and even more unthinkable that we shall part with our diminishing store of raw fuel in the future, as in the past, while at the same time purchasing from abroad the manufactured products derived from it. We have in the past been prodigal in the expenditure of our fuel wealth; the nearness of our coal areas to the seaboard apparently supplied the incentive for our coal export business, on which, no doubt, both colliery and shipping interests have done exceedingly well, and unfortunately there are many people who regard fuel economy at home merely as a means of increasing our exports of raw fuel—of hurrying up the process of parting with additional tons of "our national capital,'" as Mr. Robertson puts it.

The German Wire Lamp Trade.

As was recently mentioned in this journal, the principal glow-lamp makers in Germany have reached an understanding and decided to raise prices in, general. It is probable that until this decision was taken the glow-lamp branch had occupied an exceptional position, as quotations had not previously been advanced in the German home market, it is said, since the outbreak of the war. This circumstance is all the more surprising in view of the great increase which has occurred in the cost of raw materials as compared with the prices ruling for these in the pre-war period. If an agreement has now been concluded, it is considered in Germany that the increase in prices possesses an importance which surpasses the limits of a simple price arrangement, as it gives expression to a readiness to come to a definite understanding. The most essential point of the new departure is the accession to the price arrangement of the Julius Pintsch Co., against which the competition of the A.E.G. group had previously been mainly directed, this group comprising, in addition to the A.E.G., the Siemens-Schuckert Works, the Bergmann Co., and the Auer Co. (German Incandescent Gas Light Co.). It is contended that advantage from the new arrangement will also be derived by the third group in the glow-lamp branch, which is formed of the factories of moderate and small size, and which produces lamps according to the drawn-wire process, the rights for which are claimed by the A.E.G. on the basis of patent rights obtained from the United States. An action on this matter is now pending before the Imperial Court. If a decision should be given in favour of the A.E.G., the firms concerned would be confronted with claims which would, it is thought, at least place them in a state of great dependence in relation to the former. If such a decision had already been given, a kind of monopoly under the leadership of the A.E.G. would have been formed, with the Pintsch Co. as the sole opponent. The latter makes metallic-filament lamps on the squirting process, which is declared to have been considerably improved in recent times, and it is assumed that this fact also has contributed towards the understanding.

It may be remembered that at one time the A.E.G. claimed the right to the designation of glow lamps as wire lamps exclusively for metallic-filament lamps produced by the drawing process, and the company succeeded in this contention in an action brought against the Pintsch Co. a few years ago. The former group argued that the term wire lamp was evidence of quality, whereas the latter submitted that the use of the name by the Pintsch Co. was justified through its having come into common use amongst consumers, especially as the company maintained that its squirting system had advantages over other methods. At any rate, the A.E.G. group gained the day.

It was, however, in another direction that this group possessed the greatest strength from an economic standpoint—in fighting outside makers, namely, from the combination of most of the installation and electricity supply branches in the hands of the great electrical undertakings. As a result of this practice, the group was able to provide a market for its products which was not endangered by competition, as the group was able to make it a condition of the supply of current that lamps and other installation materials should also be obtained from the same source, the consequence being that the market possibilities of the remaining firms were proportionately restricted as the strength of the joint undertakings increased.

The French Electrical Industry.

A FAVOURABLE opinion respecting the prospects of the electrical engineering industry in France is entertained by M. Laurent, president of the Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. It appears that large extensions of the company's works have been carried out during the past year, the volume of business has been greater, and the profits realised have permitted of the payment of a dividend equal to that which was paid in the last few years preceding the war. Not unnaturally the question arises as to whether this development will come to a standstill or, at all events, slacken, after the cessation of hostilities. The view of M. Laurent, which was put forward at the annual meeting held recently, is that everything points to the development being maintained. The difficulties which have arisen owing to the inadequate coal resources in France have clearly shown in recent months the necessity for substituting water power for coal as much as possible now, and also in the period after the war, when many urgent requirements will arise. In this connection, the president of the company in question considers that an almost unlimited field for the manufactures of the electrical engineering industry will be opened up by the establishment of new hydro-electric works, the conversion of a part of the railways to electric traction, and the numerous applications, which are tentative to-day, but will be assured to-morrow, of electric power to the chemical and metallurgical industries. At the same time, the invasion by German products will be at an end in the French home market, and in those of the Allies. It may also be necessary to extend and modernise the telephone system, which is deemed to be quite inadequate for its purpose, whilst the telephone and telegraph installations in the departments invaded will have to be re-established. It is, therefore, concluded that the future will be a time of great activity, for which preparations must be made at the present time.

STAFF ORGANISATION IN ELECTRICITY SUPPLY UNDERTAKINGS.

[COMMUNICATED.]

Much has been written on the subject of organisation in electricity undertakings, but no attempt has, so far, been made towards the standardisation of designations in connection with staff positions in these undertakings. The reason for this is probably that local conditions vary so much, and what is regarded as an important position in one municipality may be of little consequence in another. Very often when an electricity official makes inquiries in another city or town regarding the status of the gentleman holding a similar position to his own, he finds that there is no position there exactly the same as his own. The appointment nearly comparable with his is held by an official who possibly has greater or less responsibility than the inquirer.

In our issue of May 4th, 1917, was published an article under the heading of "Promotion in Electricity Supply Undertakings," in which the duties and responsibilities of electricity officials were set forth. The remarks contained therein were based on the supposition that the following system of staff organisation was adopted. This system should be found very suitable for undertakings having a plant capacity of between 10,000 and 50,000 KW.:—

CHIEF ENGINEER AND MANAGER.
- CHIEF ASSISTANT.
  - STATION ENGINEER.
    - BOILER-HOUSE SUPERINTENDENT.
      - Technical Assistant.
      - Charge Engineers { Shift Engineers. / Switchboard Attendants. / Drivers. / Firemen. / Trimmers. }
      - Fitters.
    - ELECTRICAL SUPERINTENDENT.
      - Sub-station Superintendent.
        - Sub-station Attendants.
      - Electrical Fitters.
  - MAINS ENGINEER.
    - ASSISTANT MAINS ENGINEER.
      - Records Draughtsman.
        - Records Clerk.
      - Jointers.
        - Foremen.
  - CHIEF DRAUGHTSMAN.
    - Draughtsmen.
  - SECRETARY.
    - CHIEF CLERK.
      - Book-keepers.
      - Typists.
  - CONSUMERS' ENGINEER.
    - METER SUPERINTENDENT.
      - Meter Testers and Repairers.
      - Meter Readers.
    - INSTALLATION SUPERINTENDENT.
      - Foreman Electrician. { Wiremen. / Installation Inspectors. / Motor, &c., Inspectors. }
      - Showroom Assistant. { Canvassers. / Salesmen. / Clerks and Typists. }
      - Public Lighting Foreman. { Linesmen. / Trimmers. }

For small undertakings below 10,000-KW. capacity many of the positions could be combined, while for large systems of over 50,000 KW., although the general scheme as outlined would be appropriate, new subordinate appointments would be necessary.

The question of salaries pertaining to the more important appointments is a matter which should receive more attention than is given in a large number of undertakings. Great divergencies in this respect are shown by a study of the emoluments in various undertakings throughout the country.

In one municipality the salaries of the electricity staff may be arranged on a reasonably graduated scale from the chief engineer downwards, while in another the chief engineer possibly receives a handsome salary, out of proportion to the small salaries of his several departmental assistants next in authority under him.

The rapid growth in the size and importance of electricity undertakings within recent years warrants a careful survey of the remuneration given to the officials responsible for the efficient and economical generation and distribution of electrical energy, which has proved such an important factor in the manufacture of munitions of war. The accompanying table of average salaries has been compiled with the view of determining the relative values of the services of those electricity officials who have had, through force of circumstances, to keep to their jobs during the present war.

TABLE OF AVERAGE SALARIES.

Designation.	2,000 KW. capacity.	5,000 KW. capacity.	20,000 KW. capacity.	50,000 KW. capacity.
Chief engineer and manager	£400	£600	£1,000	£1,500
Chief assistant	250	300	500	700
Station engineer	200	230	400	600
Boiler-house sup'tendent	—	—	250	300
Electrical superintendent	—	—	250	300
Mains engineer	180	200	350	500
Assistant mains engineer	—	—	250	350
Chief draughtsman ...	150	180	300	350
Secretary	130	160	280	300
Chief clerk	—	—	200	220
Consumers' engineer ...	200	220	350	550
Meter superintendent ...	—	—	220	300
Installation sup'tendent	—	—	220	300

TARIFFS IN THE ABSTRACT.

At the present time, when our American friends are discussing the simplification of their tariffs for electric supply—a matter which, judging from the samples quoted in their papers, should present little difficulty—we can the more readily congratulate our own supply authorities on having in so many instances been able to institute simple tariffs, understandable by the average consumer, and yet so drawn up as to safeguard those technical essentials which are necessarily factors in a commercially successful tariff.

Any tariff scale, however simple, is in effect an attempt to average out the value of the service rendered to a particular class of consumer; the simpler the tariff—assuming always that it has been determined on technical and commercial considerations—the greater the number of determining factors which have been averaged out, while a complex American tariff, such as the following, which is supposedly intended to cultivate electric cooking on the low rate, is an attempt to meet each individual phase of the consumer's demand or service with an equivalent rate value:—

> American rate based on active rooms; has a primary step of 10 cents per KW.-hour for 4 KW.-hours for each of the first four active or counted rooms, and for 2·5 KW.-hours for all additional counted rooms; a secondary step of 5 cents per KW.-hour for all energy over that paid for at the primary step up to a total of 7 KW.-hours per counted room, and a third step of 2 cents for energy consumed per month over 7 KW.-hours per counted room.

This tariff is designed for the same purpose as our own "Domestic" tariff of, say, "12½ per cent. of the rateable value of the house plus ½d. per unit," which has been obtained by broadly averaging the determining factors affecting value of service and applying them in a form which is simple and can be understood by the consumer—*i.e.*, in a commercial form.

In comparison, the American tariff is unwieldy and uncommercial, and though we grant that it may be more scientifically correct, its equity, nevertheless, depends on the accuracy with which the average service value of each step, for the particular class of consumers concerned, has been determined.

When we consider that the cost of a KW.-hour supplied to a particular consumer depends on the distance and method of delivery, the time at which, and during which it is delivered (*i.e.*, the effect on the generating plant of the incidence of its delivery as regards the supply of energy to other consumers), as well as on the degree of efficiency of the generating plant, and sundry other lesser technical and

operating considerations which, though pregnant with significance to the engineer, are as Greek to the consumer, and that the tariff has to perform the dual function of embodying the complex desires of the former in the simplest possible form which will appeal to the non-technical imagination of the latter, it will be obvious that it must in every case, irrespective of its simplicity or complexity, be an abstract assessment of value of service, based on a complex average.

The engineer, recognising the practical impossibility of framing any single tariff which will meet the conditions of all consumers, proceeds to classify the latter into grades, nominally according to the average cost of service for each grade, but frequently according to the average commercial value attaching to the service, which may be greater or less than the cost, and depends on the commercial policy adopted by the supply authority.

In any case, the exact cost of supplying an individual consumer is indeterminate, unless he is the only consumer, or each individual consumer has a fixed load characteristic relative to the others, and it is conceivable that, under certain conditions, a group of a dozen consumers, with a great diversity of load characteristic, might be supplied at even less actual cost than one consumer having the desirable all-day load.

Tariff classification has its drawbacks, for the wider the average of a class is drawn, the greater the variation in actual cost as between good-paying and bad-paying—possibly unprofitable—consumers; true, the latter may, by reason of the assistance rendered by the former, more readily develop their demand into a paying load, but meanwhile the development of the former as a sub-class is held up.

To the engineer, tariff classification is an expedient based on imaginary zones of service value: the actual cost of generating electricity is, on the other hand, a very real thing, though varying from hour to hour according to the effect on the plant of the incidence of the individual consumers' loads. The consumers' loads may be likened to the parts of a jig-saw puzzle, which, when fitted together, will give a connected and uniform result; the greater the degree of perfection attained in the fitting together, the less the cost to the generating station, irrespective of the size of individual loads.

This does not mean that a small consumer can be supplied at the same rate as a large one, because obviously distribution and connection charges affect the result, but it does mean that it may be no more costly to supply a number of short-hour consumers having a considerable load diversity, than one long-hour consumer, provided the former utilise the generating plant to the same extent, and do not incur excess connection charges, and that discrimination against the short-hour consumer, just because he is a short-hour consumer, is not justified.

Clearly, it does not concern the generating engineer where the output goes which gives him his 40 per cent. load factor, provided he can keep to that condition of affairs; similarly, it matters not a jot to the supply authority that an individual consumer is of the short-hour type, provided that his load with the others, short or long, assists in producing a long-hour demand.

Most supply engineers, from technical considerations, regard the peak load as the bane of their existence, and if anathema could hinder what is, after all, a normal development of supply, there would be no peak-load consumers. The general supply has always had a peak load, and probably always will have one of a kind, at some time during the 24 hours, and it is absurd to condemn the consumer—often enough it is the beloved long-hour man—for doing just what you have asked him to do, viz., make as much use as possible of the supply.

The consumer can legally command a supply of electricity at any time, and the engineer must, perforce, provide plant to meet such requirements; that this plant is unused for many hours in the day is surely the fault—if fault it can be considered—of users at other times of the day who are not sufficiently enterprising to make use of that which is necessarily provided.

The tariff scale, as a rule, is such as to encourage the long-hour consumer, or class of consumer giving equivalent conditions, a premium being placed on "duration of use," with or without restriction of demand.

To restrict the demands of individual consumers during the day is to accentuate the evening peak, and it would be more logical to encourage peaks during the day to counterbalance that during the evening. This object is, of course, more or less achieved by the domestic tariffs of the "point five" type, as also by rates which place a premium on "time of use" off the peak.

In this connection domestic tariffs which have no demand restriction, and offer a low uniform secondary charge, appear to offer great possibilities, as although the consumer is unhampered as to the use of energy at any time, it is evident that a practical limit exists to his lighting requirements, while the limit of his requirements for other purposes, largely during the day, for which such a tariff directly caters, has not yet been ascertained.

On the other hand, it is probable that the ordinary separate lighting tariff is an indirect cause of the peak load, because the ordinary lighting consumer has the impression that each unit costs, say, 4½d., and that he must economise, which he does by restricting his use to peak-load hours: if he should realise that a lower heating rate is available, the disproportionate initial cost of taking advantage of it must be a serious deterrent.

The prospect of developing the heating and cooking load looms so very largely in the future, that one is tempted to speculate as to the ways and means of hastening it.

It seems probable, for instance, that if 75 per cent. of the householders in a street containing, say 100 houses, were to combine and co-operatively purchase energy in bulk for resale at cost price to themselves from the supply authority, at the same time guaranteeing a certain average wattage of heating or cooking apparatus installed, this group of consumers would progress electrically at a much greater rate than the average consumer throughout the area. The street would offer a favourable load, and any improvement brought about by this progressive group of consumers would be reflected in a reduction of charges to them, thus tending to still further development. The supply authority would obtain its most favourable conditions—viz., long-hour use and concentrated load—the street being equivalent to an American apartment house. If these same consumers were to purchase or hire their apparatus co-operatively, they would at the same time reduce the initial cost of their venture.

Any street or residential area of suitable character, in which a sufficient number of householders agreed to the conditions, could be dealt with on similar terms, a co-operative domestic rate being instituted for the purpose. In effect, such a scheme would sort out the good consumers from the bad and indifferent, rewarding them as a class according to their merits, and intensify and hasten on the domestic use of electricity and electrical appliances amongst those sections of the community most suited for the purpose.

Some towns possess areas suited to intensive development, and some do not; and whereas it is impracticable to apply intensive development on a scale suited to a whole city, it is reasonable to assume that such development is possible in the case of a selected section of the community, and that it might result in a type of super-domestic consumer, whose example and experience would be of great value as an incentive to less enterprising consumers, who would all along benefit indirectly from the general improvement in conditions of supply of energy and apparatus.

A New Power?—According to *Indian Engineering*, Mr. J. A. Hamilton, during the course of a speech at the annual meeting of the Central Engine Works, Singapore, observed that a new discovery had recently been made which, it was said, would completely revolutionise all the known systems of power transmission. "The possibilities of this new system have been readily recognised by the War Office and the Admiralty, and the commercial world has therefore been ignored entirely; in fact, the whole output is taken up for war purposes, and the Germans on the Western Front know to-day that some new power has been discovered, and have been speculating as to what it is. After the war, this system will be available; it will revolutionise all forms of power transmission, and will be highly beneficial to rubber estates, tin mines, and to all power users."

COAL TRANSPORT REORGANISATION SCHEME.

As is well known to the majority of our readers, one of the pressing questions brought about by the conditions of the moment is that of ensuring the coal supply of the community.

This is largely a transport difficulty, and, in order to overcome the latter, the Controller of Coal Mines has devised a scheme, which is to come into operation on September 10th, whereby it is estimated that no less than 700 million ton-miles will be saved annually in the transport of coal by public railway.

Great Britain has been divided into 20 areas, and the scheme relates solely to that portion of the coal which is being transported from area to area for inland consumption. In other words, it bears chiefly upon coal which is being conveyed for long distances or cross-country journeys, both circumstances being prolific sources of trouble in view of depleted railway staff and rolling-stock of all kinds.

This scheme, being designed to relieve transport, is based on four main issues :—(1) That consumption of coal should take place as near the producing point as possible ; (2) that in view of the superior facilities afforded by the main trunk lines, the movement of traffic should follow these routes wherever possible ; (3) that the movement of coal should, as far as possible, be in well-defined directions, viz. : —North to South, North to South-east, North to South-west, East to West ; (4) that an area producing less coal than suffices for its own needs should not send any portion of its output to other areas ; and that an area producing more coal than it requires for consumption within the area itself should only distribute the balance to adjacent or convenient areas.

The only limitation in regard to Clause 4 is the need for providing fuel of a special type for certain purposes, and this need has been determined by getting into touch with consumers direct. In this connection arrangements are being made for the issue of certificates authorising supplies of coal of a special type required by steam raisers for special purposes—*e.g.*, mechanical stokers, gas producers, &c.—and collieries, factors and merchants will be precluded from supplying special grades to consumers in the absence of a certificate issued to the latter by the Controller of Coal Mines.

In the various areas District Coal and Coke Supplies Committees are acting as the Controller's representatives in all matters relating to coal. These Committees have been empowered by the Controller to conduct the necessary arrangements for putting the new scheme into force. It is considered that a minimum of inconvenience will thus be caused to all concerned, as collieries in each area will thus be placed in direct touch with the factors, merchants, and direct consumers whose supplies they will have to provide in future. There will consequently be no necessity for those whose supplies are affected under the scheme to proceed in search on the one hand of new customers, or, on the other, of new collieries. As a safeguard, however, should any factor, merchant, or direct consumer not hear from a colliery by August 27th, 1917, that it is authorised to send supplies, a communication may then be made to the District Coal and Coke Supplies Committee concerned, stating full particulars, in order that inquiries may be conducted and arrangements made for supply before the scheme comes into operation throughout Great Britain on September 10th, 1917.

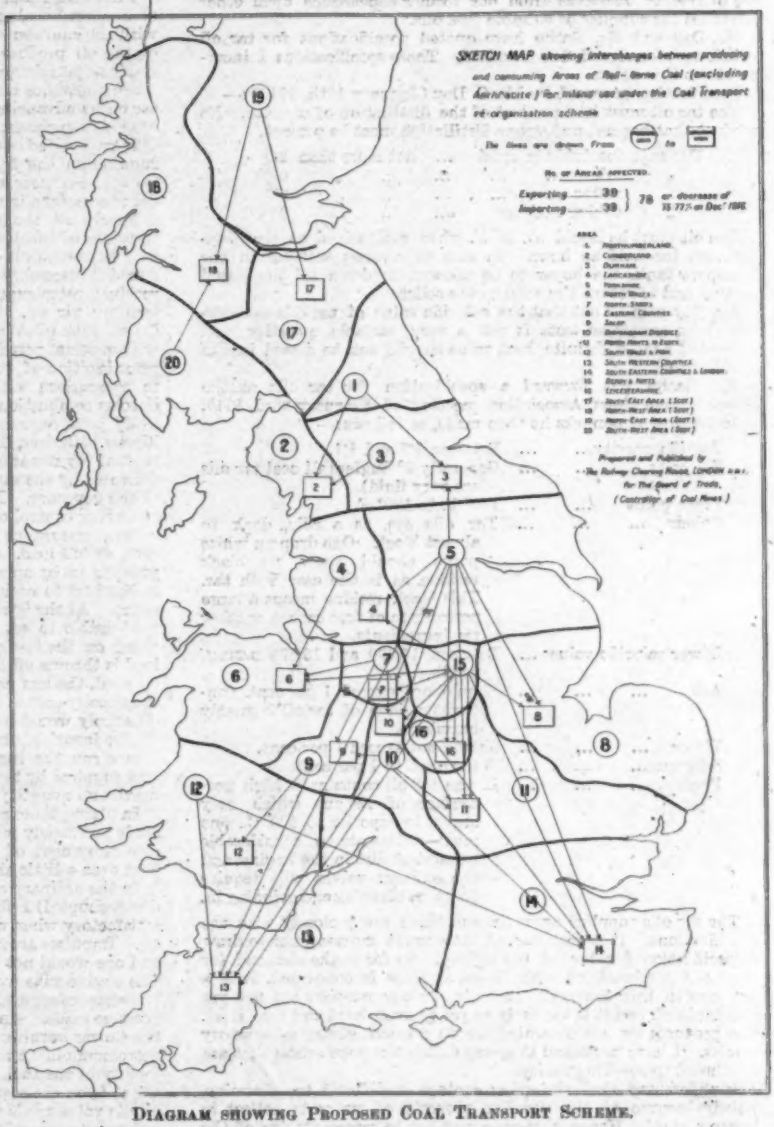

SKETCH MAP showing interchanges between producing and consuming Areas of Rail-borne Coal (excluding Anthracite) for inland use under the Coal Transport re-organisation scheme
The lines are drawn From ... to ...
No. of Areas affected.
Exporting ... 39
Importing ... 39
78 or decrease of 15 77% on Dec' 1916
Prepared and Published by
The Railway Clearing House, LONDON N.W.
for The Board of Trade,
(Controller of Coal Mines)

DIAGRAM SHOWING PROPOSED COAL TRANSPORT SCHEME.

The movement of coal within the areas themselves—*i.e.*, coal produced and consumed in the same area—remains undisturbed, and contracts will not require to be cancelled.

In the case of coal affected by the scheme, however, existing contracts will be cancelled at 6 p.m. on Saturday, September 8th, and new contracts, to be arranged between now and that date, will come into operation on Monday, September 10th.

Not only should the new scheme result in reducing congestion on the railways, but it ought to assist the coal trade generally in getting a better turnover for their wagons, and tend to minimise stoppages at collieries due to delays in the working back of empty wagons over long distances, or from awkward points involving cross-country working.

In developing the scheme generally there has been a free interchange of views with the District Coal and Coke Supplies Committees as representing the colliery owners, and meetings have taken place with representative factors and merchants, and the Controller is also in touch with the Railway Executive Committee with a view to ensuring that adequate arrangements are set up to meet changed directions in the flow of traffic.

All concerned are strongly advised to secure the map diagram reproduced herewith, and the pamphlet, as referred to in the official notice, as these documents will be found to be of material assistance.

It is emphasised that this scheme does not affect water-borne coal, either export, coast-wise or bunkers, anthracite or coke of any description.

It is anticipated, from inquiry, that very few industries will experience difficulty.

At a recent meeting at which the scheme was explained, the question of varying the local health regulations, in view of the mixed quality of the coal which may be supplied, was raised ; it was also pointed out that there should be some protection for the consumer in regard to price, and that the Price of Coal Limitation Act had not proved very satisfactory in this matter.

Maps have been prepared showing the division of Great Britain for coal distribution purposes, and an explanatory memorandum contains particulars of the areas to which the forwarding of coal for inland consumption is confined, for (1) steam and manufacturing ; (2) gas and coking ; (3) domestic use. It also contains a list of District Coal and Coke Supplies Committees responsible for the various areas, and a list of places which are just within the scheduled areas.

40,000 Electrical Employes Subscribe to the War Loan.—As an indication of the general interest of electrical workers in America in providing the sinews of war, the following information taken from the *New York Times* is illuminating :—40,000 employés of the General Electric Co., of New York, have subscribed for $3,000,000 worth of "Liberty Loan" bonds, an average of $75 per individual. The subscriptions were received from the Schenectady, Lynn, Harrison, Fort Wayne, Erie, Pittsfield and other works of the company, as well as from their district offices, and are symptomatic of the attitude of the whole of America.

D

TAR OIL FUEL AND DIESEL ENGINES.

BY GEOFFREY PORTER, A.M.Inst.C.E.

(*Abstract of paper read before the* DIESEL ENGINE USERS' ASSOCIATION.)

WITH us the adoption of an oil fuel other than residual petroleum oils or shale oils has not recommended itself until comparatively recently, owing to the favourable terms on which we have been able to obtain imported residuals. But the force of necessity has compelled us during this period of war to look elsewhere for fuel supplies. Such sources exist in the coal deposits of our own richly endowed land, and they are being brought into utilisation by native talent and skill. It is not impossible that we are on the eve of freeing ourselves from our former dependence upon other countries for supplies of suitable fuel oils.

Mr. Day and Mr. Batho have quoted specifications for tar oil which may be regarded as standard. These specifications I incorporate at this point.

Specification proposed by Mr. C. Day (January 19th, 1916) :—

The tar oil must be a product of the distillation of coal tar. No product that has not undergone distillation must be present.

Per cent. insoluble in xylol	...	not more than			2·0
„ ash	...	...	...	„ „	0·80
„ water	...	...	...	„ „	2·5
„ coking residue		...		„ „	3·0

The oil must be liquid at 60° F. when maintained at that temperature for half an hour. In case of crystals settling in the transport tank, the buyer to be allowed to drain off the liquid portion and to return the solid to the seller.

Mr. Day pointed out that the calorific value of tar oils as determined by numerous tests is not a very variable quantity, and suggested that a definite heat value should not be stated in the specification.

Mr. Batho put forward a specification for tar oils at the Diesel Engine Users' Association meeting of February 23rd, 1916, in the course of remarks he then made, as follows :—

Specific gravity	...	Between 1·0 and 1·1.
Viscosity	...	Generally 2° Engler (all coal tar oils are very fluid).
Flash point	...	100° F. to 130° F.
Colour	...	Tar oils are, as a rule, dark to almost black. One drop on white paper should show no black residue, as is the case with tar. This black residue means a large percentage of free carbon or other tar ingredients.
Lower calorific value	...	Between 15,800 and 16,500 B.TH.U. per lb.
Ash	...	Should not exceed 1 per cent. (unburnt residue of tar oil is mostly harmless).
Water	...	Should not exceed 1 per cent.
Sulphur	...	·5 per cent. to 1 per cent.
Pitch	...	If the tar oil contains a high percentage of residue which only begins to vaporise at 400° C., one must anticipate a considerable amount of dirt in the engine, and the exhaust valves will require frequent cleaning and grinding in.

The tar oils supplied agree in substance fairly closely with the specifications. It is desirable, at the present moment, not to draw a specification for tar oil too tightly. So far as the demand for these oils in connection with Diesel engines is concerned, it is a new one in this country. Tar oils for our purpose are not yet standardised, and it is too early as yet to draw hard and fast lines. The products we are obtaining are, in general, giving satisfactory results. I have not heard that any difficulties have arisen that are attributed to specific gravity.

I understand that the water content is difficult to determine, chiefly because of the peculiar property of water to collect in pockets in oil. Hence a sample may not be representative of the bulk, and *vice versâ*. Further, the oil enters into ebullition at 212° F. Tests of water content must, therefore, be accepted with caution. Owing to the high specific gravity of the tar oil, water is not so troublesome in ordinary engine operation, as it rises to the top of the service tanks. With petroleum residual oil the reverse is the case, and water occasionally will stop an engine if the attendant is not careful.

The coke residue item must be carefully studied. I have seen tests which indicated a coke content as high as 26 per cent. Such an oil would be unsuitable for use in a Diesel engine.

As suggested by Mr. Day, the calorific values agree fairly closely with one another and with the specifications. The lower calorific value is the important one. Below a value of about 15,800 B.TH.U. per lb. the oil is unsuitable for use in Diesel engines.

The proportion of the constituents insoluble in xylol is an important matter. It is essential to reduce the amount of suspended solids in the oil to an absolute minimum, for they form nuclei for the formation of deposits which carbonise and give rise to difficulties in working an engine. ("Xylol" is described as dimethyl benzol, and has the chemical formula $C_8 H_{10}$; its boiling point is 139°.)

The M.A.N. specification requires the oil to remain liquid at a temperature of 46·5° F., when it is undisturbed for a period of half an hour, and to be fully liquid at 61° F. Mr. Day's specification concurs. Those of us who have been using tar oils for the first time during a particularly cold winter have learned by experience that this desideratum is not merely a chemist's fad. At a temperature below 45° F. crystallisation is heavy. In one instance I found fully 30 per cent. of the contents of a tank of oil (out of doors), containing 11 tons, to be extremely thick. It could not be pumped at all. Heating a gallon drawn out in a pail dissolved the crystals, but to heat the whole tank was impracticable. Finally the difficulty was overcome by violently agitating the bulk, when the oil became fluid. This method was adopted throughout the winter as occasion required; it cost nothing, and was quite successful. From our experience up to the present one fact emerges, *i.e.*, that tar oil is better stored under cover in a moderately high temperature than in the open.

I have been particularly interested in examining indicator cards of engines burning residual petroleum oil, tar oil alone, and tar oil with the addition of a pilot jet of residual petroleum oil. The use of tar oil produces greater temperatures than does the use of a residual petroleum fuel oil, but the increase is not of high value when allowance has been made for the slower burning property of tar oil by advancing the fuel admission. The starting cards I have been able to obtain appear to be normal; I have not detected any difference of consequence between such cards taken from engines running on the fuels mentioned. In the engine fitted with pilot jet ignition gear under my own charge sudden pressure increases occur occasionally at starting.

Nearly all the cards in my possession, taken at fairly high fractions of full load, are of good shape. I believe that all of us who have used tar oil, with or without pilot jet ignition gear, have found it necessary to advance the fuel admission, the setting for residual petroleum oil being generally too late for the slower burning tar oil. In general, a card taken from an engine using tar oil with pilot jet ignition is not so nicely shaped as a card taken with residual petroleum alone, or with tar oil alone as fuel. The prior ignition of the pilot jet produces a "peaked" admission line in comparison with the regular, slightly drooping curve, which denotes combustion at constant pressure.

My own experience has been with an engine equipped with Messrs. Mirrlees, Bickerton & Day's pilot jet ignition gear, and most of my remarks will refer to this engine. The tar oil supply is delivered by the main fuel pump to the cylinders under the control of the governor. The ignition oil is independently supplied, but is not under control of the governor. The quantity of ignition oil is a fixed amount at all engine loads. The ideal quantity is 5 per cent. at full load. The quantity of oil delivered by the ignition pump is set by an arrangement which permits the same adjustment to be given to each pump, each cylinder having its own ignition pump. As the ignition pump is not controlled by the governor, it is advisable to set the governor to keep the engine speed if anything on the low side, as the engine may "run away" when the load is thrown off suddenly. The smaller the quantity of ignition oil used, the less probable is this condition. The provision of some electrically-controlled safeguard in connection with the ignition oil supply would be a desirable feature to adopt. In starting, the engine invariably runs out 20 to 30 revolutions above normal speed. I have run the engine on 4 per cent. of normal full load on the fuel supplied by the ignition pumps alone when set to deliver their maximum quantity.

In fitting these pumps, too much care cannot be taken. Fitted studs and steady pins should be used to preclude the possibilty of any movement of the pump body. The adjustments are so fine that even a little shake will affect the oil delivery.

In the ordinary course of running the engine (driving a dynamo direct-coupled) I find the speed control by the governor to be as satisfactory when using tar oil as when burning residual petroleum oil. Impulses are regular; it is seldom that a cylinder "misses"; and one would not be aware that a change of fuel had been made. The engine runs well even on $\frac{1}{10}$ load.

Before commencing the use of tar oil, one or two adjustments must be made. An earlier fuel admission is necessary, owing to the slower burning properties of the oil as compared with residual petroleum oil. I think the amount of the advance depends on the quality of the fuel. In my own experience, I find an advance of about 1° on the crank circle suffices. Similarly, the closing of the needle valve needs a rather earlier adjustment. The only definite method to adopt is that of trial and error. As with residual petroleum oil, the condition of the colour of the exhaust is a guide to correct timing. I have had no difficulty in obtaining colourless exhaust at all loads with injection pressures of the same magnitude for tar oil as for residual petroleum oil. When attempting to use tar oil without ignition gear, I found it necessary to reduce the injection pressure to a large extent in order to obtain satisfactory operation. Those engineers who use tar oil as the sole fuel have also found the reduction of the injection pressure essential for steady operation.

Another important point to consider is the compression pressure in the cylinders at no load. This pressure should not be less than 480 lb. per sq. in. Below this figure, both the ignition of the tar oil and of the residual petroleum oil may be uncertain; and even if regular ignition is obtained, combustion may be incomplete, leading to smoke and high exhaust temperatures. The engine in which I am interested had been at work for a period of 14,000 running hours before being adapted to tar oil fuel. Nevertheless the engine has done consistently good service, using tar oil, for the past nine months, in April last being at work at 65 per cent. of full load (average) for 497 hours, or 16½ hours per diem. Mr. Prentice has also obtained very consistent working with the engine he is

operating with tar oil without a pilot jet. He informs me that the engine has been operated for 2,250 working hours at ¼ of full load during nine months, or about 8¼ hours a day.

I think it very desirable to fit relief valves to the cylinders when using tar oil. Increases of pressure do occasionally occur at starting, and it is essential, in my opinion, to take all reasonable steps to avoid adding to the already high stresses in the engine parts. The relief valves are set to lift at 750 lb. per sq. in. In the event of a number of "misses" causing an accumulation of fuel on the piston head, and this accumulation suddenly firing, very considerable excess pressures may arise. It is improbable that any relief valve will prevent an explosion, but it will give useful warnings and will take care of all minor pressure troubles.

Pistons become very dirty; the rings become fast in their grooves, and should be examined at three months intervals. The exhaust valves give no trouble. They are cleaned and ground-in at intervals of 250 running hours. I am still using the original exhaust valves supplied with the engines five and a-half years ago. The fuel pumps are rather more troublesome than formerly, owing to the greater amount of sludge found in them. The lower viscosity of the tar oil also renders it more difficult to maintain the plunger glands tight than was the case when using residual petroleum oil.

In the pulverisers we have endless trouble owing to the choking of the cone grooves and rings. Frequently also the passages in the fuel valve casing become choked. The deposit collects rapidly; under the conditions I am familiar with, the deposit must be removed after 50—60 hours' running at about 65 per cent. of full load. If the fraction of full load is greater, the deposit forms more rapidly. This difficulty is very generally found by engineers using tar oil. All tar oils do not show it, and others do so in varying degrees. On some days the deposit is very slight, at other times very heavy; sometimes exceedingly hard, and again very soft. Some engineers have told me that their pulverisers have choked in 12 hours and less. In some instances the deposit is normally so great that it is necessary to reduce the full-load rating of the engine. In my own case the deposit has been less since the warm summer weather set in, and this inclines me to suppose some connection between the crystallisation of the oil in the storage tanks and the deposit in the pulverisers. The cause of the deposit is still obscure. Several engineers have completely got rid of deposits by adopting another pattern of pulveriser. A type which secures the pulverising of a filth of oil appears to be satisfactory. In my own case, the choking of pulverisers is merely a nuisance, for other engines are available when the engine burning tar oil is shut down to clean out pulverisers. But for an engineer who cannot ring the changes on his plant, the matter is something far more serious than a mere nuisance.

Another small point from personal observation is the sweeter running obtained by increasing the injection pressure at all loads by about 20 lb. per sq. in. The "cadence" of the engine and the operation of the top gear are then very much more regular. No doubt pulverisation is improved, the impulses are more even, and the governor runs more steadily.

Finally, tar oil is very unpleasant to handle; it is very fluid. The standard of engine and engine room cleanliness, and also of personal cleanliness, is much more difficult to maintain than was the case with residual petroleum oil. I fear that the filthy properties of the oil are inherent, and must be borne with in a philosophical spirit in view of the commercial advantage accruing from its use.

My own engine (fitted with pilot jet ignition gear) has provided the following results from September, 1916, to the end of April, 1917 :—

Hours running	2,671
Average load	58·5 % of full load
Weight of oil fuel per KW.-hr. (tar oil and resid. pet. oil)	·826 lb.
Pet. oil as per cent. of tar oil	14·9 % by weight
Estimated saving by comparison equiv. cost of pet. oil	·494d. per KW.-hour (in cash, £372 7s. 9d.)

On an investment of £160 (the cost of fitting the gear) the return is a handsome one.

The following figures from the daily records relate to fuel consumptions at various fractions of full load, and include both tar oil and the pilot jet oil :—

At 34½ % of full load	...	1·64 lb. per KW.-hour.
„ 42 % „ „	...	1·02 „ „
„ 67½ % „ „	...	·70 „ „
„ 74 % „ „	...	·66 „ „

The next table states the percentage of petroleum oil to tar oil at various loads, in accordance with the adjustments adopted in the ignition oil pumps :—

At 20—29 % of full load	17·5 %
„ 40—49 % „ „	16·4 %
„ 50—59 % „ „	15·0 %
„ 60—69 % „ „	13·9 %
„ 70—79 % „ „	13·3 %

If these figures are plotted on squared paper a straight line results, as should be the case, and if the line is continued to ascertain the percentage at 100 per cent. of full load one finds 10·3 per cent. as the proportion of petroleum oil at that stage.

I have run the engine many times on lower proportions of petroleum oil, but found that firing was at times uncertain. Ultimately I fixed upon the proportions stated above. I am afraid 5 per cent. is only attainable under ideal conditions.

The figures given in the two tables below relate to a pair of exactly similar engines (under my control), the one burning residual petroleum, the other tar oil with a pilot ignition jet. Higher efficiencies are obtained with the oil of the lower calorific value. I assume the result has its origin in the fact that the residual petroleum oil we are now obtaining has a lower heating value than the oil obtained before the war broke out.

FUEL OIL—RESIDUAL PETROLEUM.

	Running plant load factor.	B.TH.U. per KW.-hour.	Overall thermal efficiency.	Cost of fuel, pence per KW.-hour.
1 ...	32·1 %	15,650	21·7	·931d.
2 ...	47·1 %	15,480	21·8	·981d.
3 ...	61·2 %	13,370	24·1	·836d.

FUEL OIL—TAR OIL WITH PILOT JET IGNITION 10·3 % AT FULL LOAD.

1 ...	36·3 %	15,005	22·6	·458d.
2 ...	47·2 %	13,229	25·79	·399d.
3 ...	49·5 %	15,205	24·23	·410d.
4 ...	62·4 %	12,615	28·9	·399d.

These figures are not the results of trials, but are taken from the daily records, and are put forward as an example to indicate approximately the limits within which results may be expected to lie. A few figures giving the reductions in fuel cost in power stations follow :—

1. Engines using pilot jet ignition gear :—
   - (*a*) Reduction of fuel cost ... £12 10s. per week
   - (*b*) „ „ „ ... ·35d. per KW.-hour
   - (*c*) „ „ „ ... ·494d. per KW.-hour
2. Engines burning tar oil without pilot jet gear :—
   - (*d*) Reduction of fuel cost ... ·26d. per KW.-hour
   - (*e*) „ „ „ ... ·400d. per KW.-hour

Owing to varying rates paid in different localities for tar oil and residual petroleum oil the above figures are not strictly comparative. I have been able to work my three engines without pilot ignition when they are loaded above 70 per cent. of full load. I am not able to guarantee so high a load factor for many hours consecutively, and I found that variations of load gave rise to very unsteady running. I therefore adopted the pilot ignition gear, which enables the engine adapted to operate steadily at all fractions of full load. I also attempted to operate with mixtures of tar oil and petroleum residue oil, obtaining fairly favourable results when using an even mixture of the two fuels. Difficulties arose in the course of time, and I came to the conclusion that the method was a dangerous one.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Furnace for High Temperatures.

An electric furnace in which can be obtained a temperature up to the melting point of platinum is almost an indispensable piece of apparatus in any laboratory. A suitable one is not easily obtained at a price that is not prohibitive.

The furnace shown in fig. 1 is simple in construction, inexpensive, and comparatively long-lived. The heating unit of this furnace is

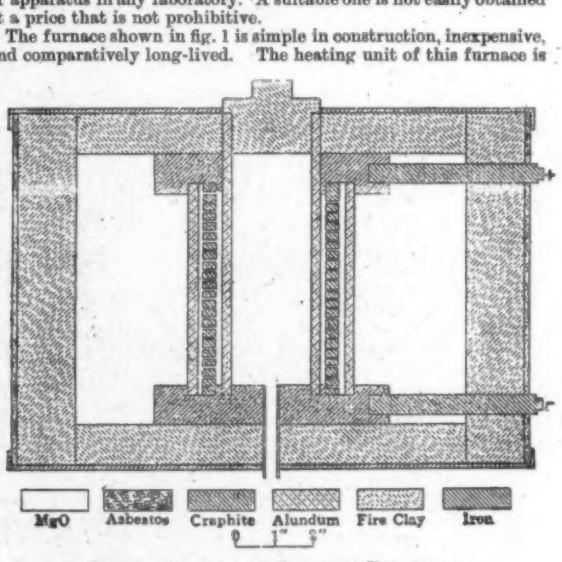


FIG. 1.—SECTION OF ELECTRIC FURNACE.

a helix of Acheson graphite made by sawing around the tube, the material sawed out being replaced with alundum cement, forming a solid tube which is comparatively strong and can be handled with ease without breaking. The alundum cement also insulates one

turn from the other and prevents gases from passing through the helix. The one illustrated requires from 25 to 30 amperes at 100 volts for temperatures ranging from 1,100° to 1,500° C. Temperatures up to 2,000° C. are readily obtained.

The graphite resistance coil is confined in a space between alundum tubes—graphite tubes may be used—to or from which gases cannot readily pass, and in which the gas constitutes an atmosphere in which the resister element is chemically in equilibrium. The gases present and surrounding the resister are chiefly carbon monoxide and nitrogen.

The body of the furnace is inexpensive and simple in construction, and if, when put together, the joints are plastered with alundum cement, it is practically impossible for air to find its way to the graphite resister, which is readily oxidisable in air above a red heat.

In this furnace, the author has made 36 heats ranging in temperature from 1,100° to 1,600° C., each for a period of five hours, making 180 hours of service. The furnace is apparently in good shape yet. When it gives way a new one is readily put in its place by removing the top iron plate, the fireclay plate, and top electrode immediately below it, also the inner alundum tube, if necessary. The new unit costs from 75 c. to $1. — A. W. FAHRENWALD, in *Met. and Chem. Engineering.*

Starting Rotary Converters Connected to A.C. Circuits.

A method of starting rotary converters whereby a machine may be brought up to synchronism without causing any appreciable disturbance in the supply mains is described in patent No. 1,224,729, assigned to the GENERAL ELECTRIC CO., U.S.A., by L. Fleischmann. The method applies to a rotary converter which is mechanically connected with an induction motor having a phase-wound secondary. For starting, the motor is connected to the alternating-current mains as an induction motor. The slip-rings of the converter are also

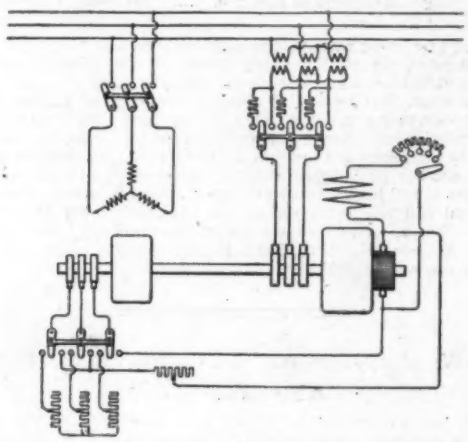


FIG. 2.—CONNECTIONS FOR STARTING ROTARY CONVERTER.

connected to the mains but through resistance, so as to apply only a portion of the normal voltage to the windings. The direct-current end of the converter is then connected to the secondary of the induction motor to supply alternating current of slip frequency. A large torque is thus produced in the motor, which pulls it and the converter into synchronism. The converter may then be connected directly to the alternating-current mains, as it will be in phase, and to the direct-current buses, as it will have the correct polarity.—*Electrical World.*

Electric Submarine Camera.

The *Scientific American* recently described an electric submarine camera for deep-sea photography, which was tested with success on the U.S. steamer *Vestal*, and is the invention of MR. H. HARTMAN, of New York.

The apparatus consists of several cylinders in a rigid steel framework, fitted with a shock absorber at the bottom, and above it a gyroscope to give stability against vibration, which is run from a 12-volt battery in the same cylinder; the three upper cylinders are roughly horizontal, the top one containing a motor and propeller to give direction to the camera. The next one is the camera tank containing, in addition to the camera and its operative mechanism, a distribution board for wiring which is carried up to the deck of the vessel, and enables the camera to be operated from the deck electrically. The third cylinder is a searchlight projector, and both this and the propeller motor are operated through a cable from the ship. The apparatus weighs 1,500 lb. in air, or about 100 lb. submerged, and is suspended from a steel wire rope. About 100 amperes at 120 to 200 volts, according to depth, are required to operate the projector, motors, &c., and the apparatus promises to be of great assistance in securing information in salvage operations, where diving is impracticable or difficult.

Trading with the Enemy.—The *London Gazette* for July 6th contains further lists of persons and bodies in a number of countries with whom trading is prohibited.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Radiators.

With reference to the article entitled "Radiators," which appeared in your issue of March 2nd, it might be of interest to you to know that, as a result of three years' close investigation into the relative merits of various designs of heaters, I am in entire agreement with the principles laid down by "Experiment."

It is not usual to associate India with electric radiators and heating apparatus generally, but, as many of your readers know, in the northern parts of this country the winter is often very severe, and fires are required from October until April. In Simla, which is at an elevation of 8,000 ft., the cold is much more intense, and some form of heating apparatus is required practically all the year round.

As the Simla undertaking is hydro-electric, power can be supplied at small cost, and during the past three years we have made every effort to develop the use of electrical radiators and heating apparatus by our consumers.

When first going into this matter, we tried every well-known British-made radiator on the market: and, in addition, we experimented with some of American make. We found, generally speaking, that very few of the radiators gave good results, and this fact, combined with the difficulty we experienced in obtaining spare parts, led us to design and manufacture radiators of our own, for which patents have been taken out. These radiators are designed more or less on the principles laid down by "Experiment," as we have realised for some time that in a radiator it is radiant heat that counts. The results we obtained have convinced us that we get more useful heat per kilowatt out of the radiators made in Simla than it is possible to get out of most of the standard British or American radiators. This is proved by the fact that many of our consumers have returned British manufactured heaters with the request that these should be replaced by those of our own manufacture, and several consumers have informed us that our 1,650-watt heater gives off more heat than 2,000-watt heaters of certain British makes.

Heaters of our make have for some time past been used largely throughout Northern India, and the demand for them is steadily increasing.

In addition to the importance of using an element of suitable design, we have found it equally important to fix behind the elements a reflector of such shape that it will assist in directing the radiant heat in the direction required. Some manufacturers use no reflectors, and others adopt reflectors of a shape that assist but little in radiating effectively the useful heat developed in the elements.

Many manufacturers use the same type of element for different purposes, but I suggest that this is wrong, and an element should be designed to meet the requirements of the particular duty the heater is meant for. If it is to be used as a radiator to give off heat with the maximum efficiency to persons in a room, the type advocated by "Experiment" is the best, but if it is to be used for purposes such as drying clothes, warming plates in a hot cupboard, &c., then an element which gives off an excess of hot air is, if anything, to be preferred.

In conclusion, I would remark that the placing of a red lamp inside a radiator is very effective, for immediately the current is switched on, the whole of the interior is illuminated with a red glow which at once creates an impression of warmth. I have found that this little addition is greatly appreciated by consumers, particularly when radiators are used in the home.

F. L. M.

India, *June 5th*, 1917.

Electro-Culture.

I trust that Mr. Leslie Miller's inquiry regarding steam static electric machines will be answered. I am afraid the voltage will not be enough, and the cumbrousness of steam generation is a drawback.

I have made a six-plate Wimshurst which promises a considerable quantity of electricity with a 4-in. spark; the plates are 18 in. glass (cost 3s. each), revolving horizontally on ball bearings. Due to not having a lathe, I have been unable to get it on to the land this year; but I do think that for small experimental plots the Influence machine will be cheaper and safer to use, and the disadvantages mentioned in your splendid article in this week's REVIEW will be easily overcome with our present knowledge.

Can any reader give me the efficiency of a Wimshurst machine? It seems to me to be 100 per cent., except for a slight leakage (neglecting friction, which is practically only the air friction of the plates).

W. A. Turnbull

Electricity Works, Aylesbury,
July 11th, 1917.

REVIEWS.

The Driving of Machine Tools. By T. R. Shaw. London: Scott, Greenwood & Son. Price 4s. net.

This book embodies a series of lectures delivered by the author at the Royal Technical Institute, Salford, and deals with a subject of constantly growing importance; as the author remarks, "control is the essence of machine-tool operation," and in this respect the electric motor plays an ever more prominent part. The days when motors were simply belted or geared to machine tools of standard design are receding into the dim past—nowadays an electrically-driven tool, to rank in the first class, must be designed as a whole, the motor forming an integral part of the machine. The author takes a broad view of his subject, and deals first with the countershaft drive, using cone pulleys and gearing, the principles of correct design being fully explained, together with the characteristics of the work to be handled by the machine, and the methods adopted in practice to vary the speed. Next the all-gear drive, necessitated by modern conditions such as the use of high-speed steel, increased power, and loftier machine shops, is described in its various forms and degrees of complexity. A chapter follows on the applications of the individual motor drive, the well-known advantages of which are clearly stated. The types of motors available, and their respective adaptabilities, are discussed; the author shows that the motor need not be rated for continuous running—a two-hour full-load rating answers for all kinds of machine-tool applications—and that an extremely flexible range of speeds can readily be obtained with the minimum amount of gearing. Starting switches and speed regulators are also described. Other chapters are devoted to planing machine drives, in which the superiority of the electric drive is self-evident, shaping machines, boring mills, &c. The volume, which forms one of the "Broadway" series of engineering handbooks, provides an excellent review of the field outlined, and should prove of great assistance to designers, students, and others concerned with this subject.

The Mechanical Engineers' Pocket-book. By W. Kent, Sc.D., and R. T. Kent. London: Chapman & Hall. Price 21s. net.

Although American hand-books have a relatively limited circulation in this country, there are some which have attained a world-wide vogue; amongst these must be included this well-known work, which is now in its ninth edition, and is in many respects greatly improved. The contents are of necessity encyclopædic in range and variety, for the wants of the mechanical engineer are infinitely diversified; turning over the pages, one is almost bewildered by the mass of tables and concentrated information herein set forth. Such matter does not lend itself to general review, and a mere catalogue of headings would be of no advantage to the reader, while it would occupy an inordinate amount of space. The only true test of a work of this kind is that of use, and having kept it constantly at hand since its receipt, we can testify to its value as a desk companion.

The chapter on electrical engineering has been revised with the assistance of Mr. D. B. Rushmore, and occupies some 80 out of the 1,500 pages composing the volume; severe compression has been necessary to deal with this extensive subject in the space allowed, but some relief has been obtained by giving references to works where particular items are treated at greater length. The matter has been brought closely up to date, and the treatment is remarkably comprehensive under the circumstances.

Taking the book as a whole, it is characterised especially by its adherence to its purpose—to be a "reference-book of rules, tables, data, and formulæ"; unlike some similar works, it avoids extended descriptions of things, which are more appropriate to text-books, and confines itself mainly to working data. In other words, it is not a guide to the novice, but a companion to the practical engineer; as such, it has gained a reputation during its career of 22 years, to which no words of ours can materially add.

The Principles of Apprenticeship Training, with special reference to the Engineering Industry. By A. P. M. Fleming and J. G. Pearce. London: Longmans, Green & Co. Price 3s. 6d. net.

The reviewer feels that he owes an apology to the authors for having delayed so long writing his review of their most interesting and informing book. The fact is that he got interested in it, so that instead of reading merely the introduction and contents pages, and basing his review on these, he read it through, and forgot that he was a mere reviewer. The scope of the book is not limited, as might be inferred from the title, to the training which the engineering apprentice receives in the workshop, but deals fully with the practical and general education which a youth should receive during and prior to his workshop apprenticeship.

In his presidential address to the Classical Association, last January, Viscount Bryce, in discussing the chief aims of education, propounded two questions, viz.:—

1. "What sorts of capacities and of attainments go to make a truly educated man, with keen and flexible faculties, ample stores of knowledge, and the power of drawing pleasure from the exercise of his faculties in turning to account the knowledge he has accumulated?"

2. "How should the mental training fitted to produce such capacities begin?"

Now, Viscount Bryce was not discussing the education of the artisan apprentice, but of the boy who will subsequently graduate at one or other of our universities, but the reply he gives to his own questions might be applied with equal appropriateness to the one as to the other. The authors will probably agree that an education which commences on the following lines is calculated to produce as good an engineer as scientist, or diplomat. The mental training to produce the result outlined above should, says Lord Bryce, begin "First of all by teaching him how to observe, and by making him enjoy the habit of observation. The attention of the child should from the earliest years be directed to external nature. His observation should be alert, and it should be exact.

"Along with this he should learn how to use language, to know the precise differences between the meanings of various words apparently similar, to be able to convey accurately what he wishes to say. This goes with the habit of observation, which can be made exact only by the use in description of exact terms. In training the child to observe constantly and accurately, and to use language precisely, two things are being given which are the foundation of mental vigour—curiosity, *i.e.*, the desire to know—and the habit of thinking. . . . What remains is to supply the mind with knowledge, while further developing the desire to acquire more knowledge. And here the question arises: What sort of knowledge?"

The answer to Lord Bryce's last question, so far as the engineering apprentice is concerned, is supplied in Messrs. Fleming and Pearce's book.

We have quoted the above not because the authors do not deal adequately with pre-apprenticeship training, but because the quotation conveys, in better language than the reviewer can command, the impression gathered from a careful perusal of the book as to the initial education which the authors consider desirable. It would be possible to quote many passages from the work under review bearing out agreement between the views of the authors and those quoted above, although the finished product is not the same; but one or two short extracts may suffice. Thus on p. 34:—

"The necessity for careful observation has been repeatedly urged by educational writers, but it is useless to expect boys to look at things which they do not understand, and to 'observe' them. If boys are to observe carefully, they must be first taught to know what they should see. . . . The observation which is valuable is that which involves notice of effects in order to appreciate causes."

In a chapter devoted to existing education in its relation to industry, the authors call attention to the fact that in the early stages "careful study of psychological processes has resulted in the introduction of methods of instruction more in harmony with the child's mind. . . . Interest and curiosity which children have in outside things is utilised to the full, and their co-operation in the process of learning obtained."

But although we appear now, as the authors suggest, to make a good start by adopting a system of primary teaching having a German name—the *kindergarten* system—the characteristic features of the system are not carried into the higher classes, and modern educational methods fail, in the authors' view, owing very largely to the fact that they are too "bookish and pedantic rather than practical." This, they consider, is the main reason for the mutual distrust existing between educationists and business men. The reviewer is not so sure that the term "mutual distrust" is quite the right one; the feeling is rather a one-sided contempt than anything which can be called "mutual." Nor, again, is the contempt directed against the bookish character of the education, but rather against its shocking inefficiency. How many boys, for instance, on leaving school and entering an office, can be trusted to add up correctly a simple money column, to spell ordinary words accurately, to address an envelope intelligently? Any business man will answer that the percentage is very small. This inefficiency of elementary education has a very retarding effect on progress in continuation and technical schools, as the teachers in these schools have to devote considerable time to teaching elementary subjects which form no part of the curricula of these schools. The efficiency of such schools is, therefore, lowered by the initial handicap under which they are placed, rather than by any inherent defect in the teaching methods.

The authors are rather severe on the evening technical school, which they frankly term a failure because, as they allege, the tuition given is of a character utterly unsuited to the character of the students who attend, or should attend, the schools. The other side should, however, not be lost sight of, namely, that the students who attend them are in great measure utterly unsuited to take advantage of the teaching which the evening schools can give them. The reviewer speaks rather feelingly on this subject, having spent many an evening teaching the rudiments of arithmetic to wiring students in order that they might understand elemen-

tary problems in electrical measurement. But what can one expect if boys obtain partial exemption from school between the ages of 12 and 14, and, after having wasted a couple of years in *cul de sac* occupations, begin to think it is time to learn a trade in which they hope to make their living? Soon they feel the need for some technical or trade teaching, and join an evening technical school, having forgotten in the meantime the elementary smattering of education they received at a primary school. It seems hardly fair to blame the evening school for failing, when labouring under so heavy a handicap. No! Let us be fair. Some of the most successful engineers in this country have received the whole of the technical training they ever had at an evening school.

Those who have not made a study of education, and have accepted the statement so often made in the daily Press, that we are miles behind Germany in educational methods, will be surprised to learn for the first time from Messrs. Fleming and Pearce's book that the system of elementary industrial education in Scotland is practically the same as in Germany, and it must be admitted is better than in England. The local education authorities in Scotland, as the authors point out, are compelled to provide suitable continuation schools having reference to the crafts and industries practised in the locality, and have powers to compel attendance; and employers may be compelled by the local education authority to provide facilities for attendance at such schools, and to reckon it as part of an apprentice's working hours. The above-named powers have been put into force in about 20 localities in Scotland, and are only suspended in others on account of the war. The *habit* of education in Scotland is so strong that in Edinburgh, although compulsory attendance at continuation schools is not in force, no less than 70 per cent. of the children of school age attend such schools.

From recent statistics it will be seen that throughout Scotland about 20 per cent. of the scholars in elementary schools pass into the continuation schools, whilst in England the number is under 2 per cent. The effect of the higher standard of education in Scotland is no doubt responsible for the high percentage of Scotsmen in responsible positions in English engineering shops, and in the mercantile marine engine rooms. How seldom is an English engineer found in a position of responsibility in Scotland! It is, however, gratifying to learn from the daily Press that Mr. H. A. L. Fisher (Minister of Education) intends shortly to lay before the House of Commons an important scheme of educational reform, embodying the main features of the Scotch system, and the abolition of the half-time system.

But the reviewer finds he is writing an article instead of reviewing the book which he has held up so long. The fact is, it is so interesting and provocative of discussion that it is difficult to keep on the track.

The economic aspect of education, and the relation of education to industry are very broadly and fairly discussed, and the arguments for and against vocational training are fully gone into. Methods of industrial training in England, France, Germany, Switzerland, and the U.S.A. are described in general terms, and specific examples of modern works schools are described in considerable detail, including the schools of the British Westinghouse Co. and Siemens and Halske; and the systems of apprenticeship in vogue at the works of Ludwig Loewe, Siemens & Halske, and the M.A.N. Works are set forth in addition to examples in leading British works. One would have liked to see some reference to the system of engineering training in the British Admiralty, a system which produces first-rate men, and to the collaboration between manufacturers, scientific institutions, and educational establishments, such, for instance, as is in vogue on the North-East Coast. The reviewer throws out the suggestion for the next edition. Sufficient has perhaps been said to indicate that the book is a valuable and timely contribution to the subject of industrial education and engineering apprenticeship training, and deserves the careful study of manufacturers and educationalists—(in parentheses, we don't like the authors' word "educationist").—F.B.

WAR ITEMS.

A Reader's Appreciation.—A Lance-Corporal with the London Electrical Engineers writes, under date July 7th:—

"It occasions me great pleasure to express my thanks for the kindness and promptitude with which you have forwarded the ELECTRICAL REVIEW during the last 12 months. If it had not been for the matter contained in its pages, and also for its high industrial influence, it is quite probable that I, and many others here, who are almost banned in the whirl of military life, would have lost all touch with the outside electrical world, and might have fallen into such a chaos of disintegration that it would have needed enormous powers of concentration to re-awaken our interest. I pass the ELECTRICAL REVIEW freely amongst my fellows, whose appreciation of its value and merits ranks high, and makes their fingers itch to grasp the good old switches of former days, and to grapple with those problems so necessary to the fulfilment of their art. On behalf of my fellow-men and myself I wish to state that our gratitude and appreciation are sincere, combined as they are with the wish for your future advancement and success."

A Union's Welcome to Disabled Men.—There was a strong protest at Rochdale Town Council against the action of the Electrical Trades' Union in declining to allow their members who are employed at the electricity station to give instruction in switchboard duties to disabled soldiers and sailors. A letter was read from the Union in which it was stated that they were trying to come to some agreement as to wages to be paid, also that no man should be discharged to allow a disabled soldier or sailor to take his place. If an amicable agreement could be come to on these points the Union would issue fresh instructions to its members.—Ald. H. Clark said the letter was one of the most narrow-minded and unpatriotic they had received for a long time. If that was an example of how workers desired to treat one another he hoped employers would show them a better.—Ald. Howarth said the Union did not seem to be helping the Government.—Coun. Shawcross said the placing of disabled men should be a subject of arrangement; it was a quite proper attitude for the Union to take, as they must not say that wounded soldiers were to be placed willy-nilly in a trade, thereby putting regular men out.

Exports from Sweden.—The Swedish Government has prohibited the exportation of accumulators, cells, and batteries, wholly or partly mounted, also electrodes cemented together.

Contraband.—In the "London Gazette" for July 3rd there appears a list of articles to be treated as absolute and conditional contraband.

Copenhagen Difficulties.—As a result of the difficulty in getting the materials for rails, telegraphs, and signals, it is impossible to complete the new underground railway at Copenhagen.—*Times.*

New Industries Established During the War.—Since the outbreak of war many new industries have been established in the United Kingdom, and goods which formerly had to be obtained from abroad are now being manufactured at home. The Department of Commercial Intelligence of the Board of Trade desires to make its record of such new industries as complete as possible, in order to satisfy inquiries for new sources of supplies, which are frequently received. Manufacturers are therefore invited to inform the Department of new industries, or new developments of existing industries, established in this country.—*Board of Trade Journal.*

Exemption Applications.—At Southwark, the Military Representative drew attention to the new list of reserved occupations, pointing out that men previously granted exemption as being in charge of the repair and maintenance of machinery, previously in the list, were now withdrawn from it. The new list only included men exclusively engaged on the repair and upkeep of machinery in munitions works or factories engaged on Government contracts. Ald. Boyd remarked that many Tribunals took no notice whatever of the certified list of occupations.

On the appeal of the manager of the U.D.C. tramways, Ilford Tribunal has given conditional exemption to C. R. Day, ticket inspector.

On a review, the Folkestone Tribunal has confirmed conditional exemption held by E. Marchant (40), clerk at the works of the Electric Light Co.

Oldham Tribunal has granted exemption until October 1st, on business grounds, to an electrical engineer and contractor (29, B 1), and until November 1st to another electrical engineer and contractor (30, Class A), whose partner is in the Navy.

At Douglas (Isle of Man), an appeal was made by L. Dyer (C 2), electrical engineer, engaged, amongst other places, at the Manx brush factory. His work was deemed to be of national importance, and he was conditionally exempted.

Before the Cheshire Appeal Court, the Chester Corporation appealed against final exemption allowed locally to the tramway traffic inspector (30, Class A), and a coach painter in the tramway department (40, Class A), and the Military appealed against three months' exemption allowed to a coachbuilder (41, B 1), in the same department. Ald. John Jones, chairman of the Tramways Committee, said they had released every available man. The Tribunal allowed until September 1st to the traffic inspector, dismissed the appeal for the painter, and also that of the Military against the coachbuilder.

At Doncaster, a Military review was made of exemption allowed to a Corporation tramways inspector (29, Class A 2). The chairman of the Tramways Committee said that they could not get proper discipline without capable men as inspectors, and they had got to the lowest limit of men if the service was to remain efficient and the routes were to be kept open. Exemption to September 30th was given, and the Military Representative gave notice of appeal.

At Aldershot, exemption was claimed for F. H. Brown (35), electrician at the Hippodrome, passed in Class B 1 after three rejections. It was stated that it was impossible to get a competent substitute. A final month was granted.

At Carlisle, Messrs. Morton defended a Military appeal against conditional exemption held by A. Munro, electrician, urged by the firm to be indispensable. The appeal was allowed, and the exemption cancelled.

At Canterbury, Mr. C. A. Blascheck, city electrical engineer, applied for exemption for G. E. Locke (38), a coal trimmer, given conditional exemption in 1916. The Clerk stated that the man was discharged from the Navy, but he had been called up again and passed in C1. Mr. Blascheck said that he thought the man was doing work of national importance, and he was exempted until a substitute is found.

Malmesbury Rural Tribunal has given exemption until October 1st to C. A. Harvey (32, Class C3), electrician to the Trustees of the Earl of Suffolk's Estate at Charlton.

On a review, the Maidenhead Tribunal has allowed conditional exemption to remain in the case of G. Lovegrove, electrical engineer. On the recommendation of the Advisory Committee, Rochdale Tribunal has given exemption until September 30th to B. R. Eves (36), tram conductor and motorman, and E. Hornby, motorman, engaged on the Corporation tramways.

LEGAL.

Controlled Firm Summoned by Manchester Corporation.

Messrs. Connolly Bros., Ltd., cable manufacturers, Mill Brow, Blackley (a controlled firm), were summoned at Manchester Police Court, last week-end, for burning trade refuse within 100 yards of a dwelling house, thereby causing a nuisance to householders in the vicinity. The summons was taken out under an Act passed in the eighth year of Queen Victoria's reign, entitled "An Act for the Good Government and Police Regulation of Manchester."

Mr. Dale, deputy superintendent of the Corporation's Sanitary Department, said defendants were warned about the nuisance by one of the departmental inspectors on May 23rd, but they repeated the offence on June 12th.

Mr. Wm. Connolly, the works manager, said the rule was for all shop refuse to be burnt in a destructor, but on each of these occasions it was burnt in a field adjacent to the works, without the knowledge or consent of the firm. He denied that they were burning the insulation off in order to recover the wire, and said the smell was caused by the incineration of used cotton waste.

A fine of 10s. was imposed.

West Ham Corporation v. Barnett & Wood.

In the Bow County Court, last week, before his Honour Judge Graham, K.C., the West Ham Corporation were the plaintiffs in an action against Ernest Richard Barnett and Wm. Stanley Wood, formerly trading as Messrs. Barnett & Wood, of Albert Works, Chatsworth Road, Stratford, electricians, to recover £18 9s. 2d.

Mr. Kyffin, barrister, appeared for the plaintiffs, and Mr. Vaughan for Mr. Barnett.

Counsel said the claim was for electricity supplied and the hire of motors. There was no dispute as to the hiring or the amount, but there was a question as to the form of the judgment. The contracts were signed by Barnett on behalf of the partners, and he asked for judgment in the usual form.

Mr. Vaughan: If that is done, it involves one being liable for the whole debt, and they dissolved partnership in January. I say that cannot be; it is not fair. If the contract were looked at, it would be seen that "we agree with them to pay for electrical energy." That was a joint agreement, and not a joint and several agreement, which was an entirely different matter. His client was only liable for one half, and the judgment should be in the form of one half each.

Judge Graham: If it would do the smallest good to separate the judgments I would do so, but it would not. Judgment for the plaintiffs for the amount claimed against the defendants.

Mr. Vaughan: Then we shall have to get an indemnity against Wood.

Mr. Kyffin: He says he will pay half.

Bloch v. Star Motor and Cycle Co.

In the Bow County Court, on Tuesday, before his Honour Judge Graham, K.C., Messrs. H. & S. Bloch, of 31, Great Colmore Street, Birmingham, wholesale small hardware merchants, sued the Star Motor and Cycle Co., of 34, Barking Road, Canning Town, to recover £51 11s. 5d. for electric torch cases supplied. Mr. Emery was counsel for the plaintiffs. It appeared that the plaintiffs' sister called on the defendants, and obtained an order for these electric torch cases, which were supplied. They were distinctly told that the batteries could not be supplied. When payment was pressed for, however, they said they could do nothing with them unless they had the batteries. The cases had not been returned, and no payment had been made. The defendants did not appear, and judgment was entered for the plaintiffs, with costs. An immediate order was asked for and obtained, as counsel said he believed an affidavit sworn by the defendants was to delay, to enable them to make away with assets.

BUSINESS NOTES.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LV. No. 267. June, 1917. This issue contains the following papers:—"High-tension Overhead Transmission Lines," by G. V. Twiss; and "Electric Wave Phenomena in the Dynamo-electric Machine," by F. Creedy.

"Steam Turbines." By J. A. Moyer. London: Chapman & Hall. Price 16s. 6d. net.

"The *Journal* of the Junior Institution of Engineers" for July contains a paper on "The Electric Lighting of Trains," by G. M. Langley, which gives a comprehensive account of most of the successful systems in use.

"Industrial Research in the United States." By A. P. M. Fleming, M.I.E.E. London: H.M. Stationery Office. Price 1s. net, 1s. 3d. post free.—This is the first of a series of papers which the Advisory Council for Scientific and Industrial Research intends to issue. Its purpose is twofold: Primarily, to record the author's observations during his recent visit to the United States; secondly, to afford material for the consideration of the position of the United Kingdom in respect of research. Amongst the companies which undertake research on an extensive scale are many whose products are well known in this country. For example, the Eastman Kodak Co. spends on research about £30,000, or 0·7 per cent. of the company's profits, per annum; the General Electric Co. from £80,000 to £100,000 per annum. The most striking features of the research work undertaken by such firms are (1) the installation in many cases of full-scale manufacturing facilities, which enable processes to be perfected without hampering the works; (2) the provision of manufacturing facilities in the laboratory in order to develop such products as result from new discoveries to the point at which the scale of manufacture calls for transfer to one of the works departments, or to a new or separate organisation; (3) the growing tendency to devote more and more of the resources of the laboratories to pure science investigations, with a view to making discoveries. Other noteworthy facts are the freedom with which results in pure science are published; the growing appreciation in the factory of the commercial value of scientific men; and the recognition of the value of research laboratories as a means of inspiring confidence in the minds of customers. There are a number of Associations of Manufacturers which undertake research work for the common benefit of their members. The research work of the universities and colleges presents many interesting features, and the national institutions which deal with industrial research are lavishly financed, either by the State or by private benefaction. The commercial research laboratories are on an extensive scale, and are well equipped. The war has disclosed in British industry an enormous latent capacity for adaptability to entirely new lines of manufacture, many of which have depended for their development upon scientific research. The research facilities are, as yet, disproportionate to the need, and there is an urgent call for the establishment of an organisation which shall maintain the creative impulse given by the war. In the light of his study of American developments, Mr. Fleming suggests that the most important alternative schemes for the United Kingdom are:—(*a*) Research laboratories in industrial works; (*b*) research laboratories for a group of works in the same industry; (*c*) the centralisation of research in the universities or colleges; (*d*) an Imperial centralised laboratory for the whole industry. Mr. Fleming adds that, in considering these policies, it is imperative to bear in mind that industry is the basis of national prosperity, and that every resource should be used to facilitate its progress.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVI, No. 6. June, 1917. New York, U.S.A.: From the Institute. Price $1.—This issue contains a report of the presentation of the Edison Medal to Mr. Nikola Tesla for his "early original work in polyphase and high-frequency electric currents." It is also unique in that a paper on the "Illumination of the Panama-Pacific International Exposition," by Mr. W. D'A. Ryan, is illustrated with 29 plates printed in colours, in addition to other figures, in order to show the wonderful effects produced by what was probably the most elaborate scheme of lighting ever brought into existence. The reproductions, which suggest photography in colours, are excellent, and form a striking innovation in a technical publication. The details of the apparatus specially designed for the scheme, and of the results aimed at and attained, are fully described in the paper.

"Circular of the Bureau of Standards," No. 33; "U.S. Government Specification for Portland Cement." Washington: Government Printing Office.

"Records of Railway Interests in the War." Part IV. From August, 1916, to April, 1917. Illustrated. London: *The Railway News*. Price 1s.

Plant for Sale.—Winchester Corporation Electricity Committee is inviting offers for a Belliss six-cylinder tandem-compound engine, direct coupled to a Parker bipolar shunt-wound generator. Full particulars are given in our advertising pages to-day.

Trade Announcements.—The removal of the Birmingham depôt of Messrs. Verity, Ltd., has had to be deferred for a time owing to the War Office having taken over part of the new building. Their address is still, therefore, 28, High Street.

Messrs. Brown, Boveri & Co., Ltd., have acquired temporary offices at 9, Old Queen Street, Westminster, S.W. 1, as from July 14th, their Caxton House offices having been taken over by the Army Council. Telephone number: "Victoria 2538."

Catalogues and Lists.—The Power Plant Co., Ltd., West Drayton, Middlesex.—Folder showing their steam turbine gears, double helical mill gears, and double reduction gears.

Messrs. Rhodes, Hodgson & Co., Ltd., 118, Tumbling Hill Street, Bradford.—Circular giving particulars of their system of supplying and cleaning sponge cloths for machinery users.

The Electrical Apparatus Co., Ltd., Vauxhall Works, South Lambeth Road, S.W. 8.—The July number of the "E.A.C." Quarterly Review contains particulars of a new form of motor-control panel and a high-tension switch pillar of the draw-out pattern.

The General Electric Co., Ltd., London, E.C., have issued an advertising novelty concerning "Freezor" fans. It takes the form of a glass showcard strutted for counter and window use, with an attractive prismatic design of the fan. It is calculated to arrest attention of passers-by. The showcards are only supplied to genuine dealers in these fans.

Dissolutions and Liquidations.—Prentice Wireless Train Control, Ltd.—This company is winding up voluntarily, with Mr. F. V. Royce, 5, Broad Street Place, E.C., as liquidator. Meeting of creditors, July 16th.

British Adding Machine Co., Ltd.—This company is winding up voluntarily, with Mr. R. L. Sare, 2, Great Winchester Street, E.C., as liquidator. Meeting of creditors, July 17th.

Market Harborough and District Motor Traction Co., Ltd.—First and final dividend 9s. 10d. in the £, payable by Official Receiver, 1, Berridge Street, Leicester.

Universal Telephone and Electrical Co., Ltd.—This company is winding up voluntarily, with Mr. J. E. Percival, 6, Old Jewry, E.C., as liquidator. Meeting of creditors July 23rd, at 6, Old Jewry, E.C. Particulars of debts, &c., to be sent to the liquidator by October 1st.

Brear & Aynsley, electrical engineers, 458, Huddersfield Road, and Albion Electrical Works, Ravensthorpe, Dewsbury.—Messrs. H. Brear & D. Aynsley have dissolved partnership as from February 28th, 1916. Mr. Brear attends to debts, &c., and is carrying on the business in his own name at Calder Wharf Mills, Aire Street, Ravensthorpe.

Charles L. Cuthbe & Co., india-rubber, asbestos and vulcanite merchants, &c., 37, Great Eastern Street, London, E.C.—Messrs. C. L. Cuthbe and E. D. Burley have dissolved partnership as from October 1st, 1916. Mr. Cuthbe attends to debts.

Bosch Magneto Co., Ltd.—Creditors must send particulars of debts or claims to the Controller, Mr. A. E. Woodington, 5, Philpot Lane, E.C., by August 13th.

Morris & Lister (London), Ltd.—Particulars of debts, &c., to Mr. H. S. Sugden, 36, King Street, E.C. 2, by August 1st.

Rose Automatic Target Co., Ltd.—Meeting of creditors on August 10th, at 14 and 15, Coleman Street, E.C., to hear an account of the winding up from the liquidator, Mr. W. Cantor.

Bankruptcy Proceedings.—C. B. Ogilvie, Whalley Range, Manchester, electrical engineer.—July 18th is the last day for receipt of proofs for dividend. Trustee, J. G. Gibson, Byrom Street, Manchester.

LIGHTING AND POWER NOTES.

Aberdeen.—The Electricity Committee has approved of an agreement to supply a local firm with a minimum of 250,000 units per annum for five years.

Birkenhead.—Year's Working.—The accounts of the Corporation electricity undertaking to March 31st last show a total income of £52,240, an increase of £4,025; expenditure amounting to £33,415, and a gross profit of £18,825; after deducting interest and sinking-fund charges, amounting to £14,977, and income-tax £1,059, there remained a balance of £2,790. Special items, amounting to £919, have been charged against revenue during the year, the net balance carried to renewals fund being £1,871, and this fund now stands at £14,065.

Bradford.—Year's Working.—The statement of accounts of the electricity undertaking for the financial year ended March 31st last, shows a net profit of £11,812, as compared with £15,988 in the previous year. The income from the sale of energy amounted to £188,500, as compared with £156,800 in 1916. The output of electricity was more than 46,000,000 units, as against 34,000,000 units in the previous year. The costs of generation were £75,600, an increase of £26,300, but the cost of distribution decreased by £260. Generation and distribution costs combined averaged 434d. per unit, as against 406d. in the preceding year. Allowances to dependents of men on military service absorbed £2,284, an increase of £673. Charges for interest and sinking fund amounted to £74,300 per annum. Practically half of the total capital expenditure of £1,100,000 had been paid off, and £36,000 now stood to the credit of the reserve and renewals account. The Committee, in view of the increased cost of working, expressed satisfaction with the result of the year.

The Electricity Committee has received an intimation from the B. of T. that the Electrical Distribution of Yorkshire, Ltd., has decided not to proceed further during the present session of Parliament with its application for a prov. order relative to Clayton and Queensbury.

Burnley.—Year's Working.—The report of Mr. Starkie, the borough electrical engineer, for the year 1916-17, shows a total revenue amounting to £34,340, working expenses £17,006, and a gross profit of £17,334, as against £16,380 in the previous year. After meeting interest and loan charges, the net surplus was £3,464, as against £4,472. Charges were increased during the year, and brought in £1,150 additional revenue, more than compensating for the added costs, but extra loan charges more than absorbed any gain under this head. The units sold totalled 5,222,626, a small increase on the previous year, due to improved power and heating business. The maximum load was 2,167 kw., and load factor 27·5 per cent.; the station plant capacity was 5,570 kw. The motor load amounted to 2,064 b.h.p. in 421 motors, and it is noted that it has become necessary to run the plant for the whole of the 24 hours in order to cope with the night load, hitherto carried by the batteries.

Bury.—Year's Working.—The report of Mr. S. J. Watson, the chief engineer, on the electricity undertaking for the year ended March 31st last, shows that 13,971,547 units were sold, or, roughly, 470,000 more than in 1915-16. Of these, 95 per cent. were supplied from the Chamber Hall power station. Some 8,700,000 units were sold for power and heat and 3,000,000 units for bulk supply; the load factor for the combined general and traction supply was 31·7 per cent. A total of 1,029 motors of 8,638 h.p. are connected to the mains. The generation and distribution costs amounted to, roughly, ¼d. per unit, and the total cost, including interest and loan charges, to ¾d., while the average revenue per unit was 8d. Both average revenue and costs have risen slightly during the past three years. The output has been maintained on an average of 2·95 lb. of coal per unit, as against 3·06 lb. in the previous year, despite the necessity of using the less economical Rochdale Road plant to a considerable extent, involving the consumption of over 1,000 extra tons of coal as compared with the Chamber Hall plant. The total revenue amounted to £46,596, while the all-in costs were £43,928, leaving a net balance of £2,668, as against £2,003 in the previous year; £1,000 was allocated to rate relief and the balance to reserve.

Continental.—Germany.—Under the auspices of the German Continental Gas Co., of Dessau, and the Provincial Authorities of Saxony a new company is being formed, with a capital of £250,000, with the object of operating the new State electricity generating station near Wittenburg. The plant, which is about to be further extended, has already an annual output of about 100 million kw.-hours.

Dartford.—Price Increase.—In order to meet the extra cost of production, the U.D.C. has increased the price of energy for lighting by 30 per cent. instead of 20 per cent., and for power by 35 per cent. instead of 20.

Donaghadee (Co. Down).—The B. of T. has decided to defer the revocation of the Donaghadee Electric Lighting Order for a period of 12 months as from August 18th next.

Grays.—Price Increase.—The U.D.C. has decided to advance the price of energy to all consumers, as from July 1st, by 8⅓ per cent., making a total increase since the war began of 33⅓ per cent., and to add to new consumers' agreements the minimum charge of 6s. 6d. per quarter.

Heckmondwike.—Price Increase.—The U.D.C. has adopted the recommendation of a special meeting that the charge for electricity be increased by 33⅓ per cent., making it 6d. per unit for lighting, and from 2d. to 4d. for power, according to units consumed per h.p., and that the discounts be reduced from 5 to 2½ per cent.

Knottingley.—The B. of T. has extended the period under the E.L. Order by a year.

London.—Bermondsey.—Year's Working.—The accounts of the B.C.'s electricity undertaking for the past year show a deficit of £7,024. The total income was £42,178. Part of the deficit was due to special charges; the new chain-grate stokers, costing £912, had increased the capacity of the boilers, whilst bulk supply apparatus costing £434, and a boiler feed pump, £297, had been installed out of revenue. War service pay, £337, and war bonus, £249, were other special charges. The units generated, including 189,020 from the bulk supply, were 7,581,914, and of these 256,444 were sold for public lighting and 6,232,255 to private consumers. The total maximum supply demanded was 2,740 kw. The units sold fell short by 207,800 of the quantity estimated, but were 240,000 more than in the previous year.

The Electricity and Street Lighting Committee recommended that the charges for power be further increased by 20 per cent. on the pre-war rate, making 50 per cent. in all, and for lighting a further 10 per cent. on the pre-war rate, making 40 per cent. in all. The Council sanctioned the increased prices, but referred the accounts back for further details.

The Finance Committee reported that with regard to £340 estimated for war service pay during the next year, it was of opinion that this should be a charge on the general rate, as well as the sums under the same heading for the last three years, making a total of £1,133 8s. 10d., and recommended accordingly. The Council adopted the proposal.

Islington.—In accordance with instructions given to dispense as far as possible with public lighting during the summer months, wherever possible the electric lamps on one side of the road have been extinguished and certain others put into lighting at a distance of about 100 yards apart. The total number of electric lamps in

lighting (exclusive of converted gas lamps, *i.e.*, lanterns on arc-lamp columns) is 412, of which 229 are lighted by arc lamps, the remaining 183 having been converted to one-watt lamps of either large or small candle power. The number of electric lamps put out of lighting in consequence of the reduced lighting is 110.

Hackney.—The B.C. has received the Arbitrator's award with regard to the salaries and wages of the staff and employés of the electricity undertaking. The award, which dates back to the first pay day in April, 1917, will increase salaries and wages by a total of £3,526 per year, made up as follows:—Officers, £770; works and running staff, £1,842; sales department, £255; destructor staff, £659.

Nottingham.—The Corporation is proposing to apply for a prov. order for electricity supply in the Kirkby urban district, amongst other places.

Oldham.—Year's Working.—The report of the joint engineers on the working of the Corporation electricity undertaking during the last year shows a total revenue of £73,555, working expenses amounting to £41,714, and a gross profit of £31,840, as against £26,698 in the previous year. Deducting interest and sinking-fund charges, the net surplus was £9,032, as against £5,107 in the previous year. The units sold were 14½ millions, against 10½ millions (roughly) in 1915-16, the power units having increased from 5,385,000 to 9,338,000 in the 12 months. The additional 4 million units sold only increased the fuel bill by about £1,700, and the works distribution and management costs fell from ·852d. in 1915-16 to ·69d. per unit in 1916-17. No doubt this result was due in part to the new turbine and boiler plant brought into use, by which the generating plant capacity was increased from 10,140 kw. to 13,140 kw. The maximum load was 6,810 kw., and load factor 24·31 per cent., as against 22·27 per cent. in the previous year. The report contains a series of coloured diagrams which illustrate the progress of the last few years, and it is worth noting that the marked increase in power units sold nearly coincides with the marked economy in coal consumption, which now amounts to about 3½ lb. per unit sold, as against nearly 8 lb. in 1913.

Rotherham.—Large Turbine Plant.—At the meeting of the B.C., last week, the purchase was authorised of a new 25,000-kw. set at the electricity works, with accessories and boilers, at an estimated cost of £275,000. This brings the total estimate for extensions, within the past year, to £675,000, an expenditure of £400,000 being authorised in March.

Sheffield.—Additional Plant.—The Government Department concerned has agreed to allocate 28,000 kw. of generating plant, boilers, &c., to the Corporation, to enable it to meet increasing demands.

Notice is being given to the Rural District Councils of Wortley, Rotherham, Kiveton Park, Norton, Chesterfield, and Clowne, and the Urban Districts of Stocksbridge, Dronfield, and Handsworth, of the intention of the Corporation to apply for a prov. order to supply electricity in their districts or parts of their districts.

St. Annes.—For the first time in its history, there is a deficit of £85 on the electricity undertaking for the year ended March 31st, attributable to the increased cost of labour and coal, and to the reduction of income due to the Summer Time Act.

Stowmarket.—The Electricity Supply Co. has notified the Council that unless certain difficulties are overcome, all its efforts will be concentrated on the Felixstowe undertaking, and the Stowmarket supply will be discontinued. The trouble is apparently due to the withdrawal of men by the military authorities, and it was suggested that the Council should ask the L.G.B. and Ministry of Munitions to take the matter up with the military authorities. It was agreed to discuss the matter in Committee.

Stretford.—The Electricity Committee has approved the continuation of the terms of the agreement until December 31st next with reference to the supply of electricity to the Stretford Gas Co., subject to an increased charge of 15 per cent., and that the clause providing for a minimum consumption shall not apply for the present year.

Swansea.—In his report on the electrical undertaking, the borough electrical engineer recommends that the installation of electric light in the Corporation dwellings at Trewddfa shall be proceeded with. It was stated in discussion that the charge to tenants would be 8d. per week all the year round.

Electro-culture.—A report has been submitted to the Electricity Committee on the advantages of electro-culture in promoting plant growth, and a Committee is to be formed to visit Hereford and study the work carried out there.

Thornton.—The B. of T. has extended the period under the E.L. Order by a year.

Walsall.—The net deficiency on the electricity supply department for the year ending March 31st last is £8,987, as compared with a deficiency of £899 for the previous 12 months. The change-over from 3,300 volts to 6,600 volts on the E.H.T. feeder to Bloxwich has recently been effected.

Councillor Haward, in discussing the balance-sheet, said it had been made very plain on several occasions that a loss was certain to be made during the transition stage from the old works to the new works. They had, however, sustained a loss which was unexpected, due to the commandeering of plant which was intended for the new power station. The consequence was that, instead of the new works being brought into operation early in 1915, it was not until February 10th this year that any plant was available for use. He considered that they had a strong claim against the Ministry of Munitions for compensation.

The Mayor mentioned that a substantial claim for compensation had already been lodged with the Ministry of Munitions.

Walthamstow.—Loan Sanction.—The Treasury has agreed to a loan of £16,387 for the purpose of extending the station, at 5½ per cent. interest, repayable both as to principal and interest, in equal half-yearly payments in 15 years. The electrical engineer has been instructed to make arrangements for the erection of an electrical siren on the Town Hall, to give warning of air raids.

Winchester.—Year's Working.—The report on the working of the electricity department for the year ended March 31st last, shows a total revenue amounting to £14,434, working expenses £8,834, and a gross profit of £5,601, as against £5,826 in 1915-16; after providing for interest and loan charges, &c., the surplus was £132, as against £575 in the previous year. The figures do not vary greatly from those of 1915-16, increased charges having made up for the falling-off due to restricted supply. The output sold amounted to 910,131 units, against 988,366 in 1915-16, of which power accounted for 328,296 and heating for 165,422 units, some 662 kw. of heating and cooking apparatus being included in total connections amounting to 2,712 kw. Heating and cooking units increased by 48 per cent. on the previous year, while in all other sections the sales decreased. The maximum load was 590 kw. and the generating plant capacity 750 kw.; 6·10 lb. of coal, costing ·724d., was used per unit sold.

TRAMWAY and RAILWAY NOTES.

Burnley.—Year's Working.—The annual report of Mr. Mozley, the general manager, on the working of the Corporation tramways, shows that over 17,000,000 passengers were carried and 1,549,000 car-miles worked. The gross income was £87,421; working expenses amounted to £58,604, and, after providing for war allowances, the balance was £25,606, being a few hundreds better than in the previous year. After meeting interest and loan charges, rents of lines, and income-tax, there was a balance of £5,222, which was placed to reserve; the previous year's balance was £6,010. The working expenses increased by £5,032, due to increased wages, cost of materials, and more repairs carried out, and Mr. Mozley includes a striking list of over 40 articles, of which the cost has increased in a number of cases over 100 per cent., while one case of 394 per cent. increase is reported. Tires show 235 per cent., axles 258 per cent., and steel 143 per cent. increase. Mr. Mozley estimates that £5,600—£6,000 per annum should be provided towards depreciation, and he does not regard the net financial result as satisfactory, although, as some £13,000 has been paid in war allowances and increased income-tax in the last three years, he concludes that but for the war the position would have been a satisfactory one.

Heywood.—There has been a loss on the tramway undertaking for the past year of £783.

Irish Electric Tramway Workers' Wages.—At a meeting of the Union of the men employed by the Dublin United (Electric) Tramways Co., it was announced that the directors had granted a further increase of 2s. 6d. per week, making a total of 3s. 6d. during the past 10 months. Cork Electric Tramway and Lighting Co.'s employés have accepted the company's offer of an increase of 2s. 3d. per week, with half an hour's less work per day and one day off in 12, to motormen and conductors, and 1s. 6d. to other branches.

Leeds.—Female Inspectors.—The Corporation is considering the appointment of women as tramway and ticket inspectors, at a wage of 30s. per week, with the addition of war bonus, rising, subject to satisfactory service, to 32s. 6d. after six months, and to 35s. after 12 months' service.

Manchester.—After a further week of obstructive tactics the employés on the Corporation tramways threatened a strike last week, and Mr. M'Elroy, the general manager, went to London to lay the position before the Minister of Labour. As anticipated, the Government stepped in, and pointed out that a strike would be illegal. Sir David Shackleton also informed the men's that if work was continued he would arrange for arbitration within seven days and a decision within a fortnight. A ballot of the employés showed a majority of 280 in favour of a strike, but it was considered too small to warrant such a step, and normal conditions have been resumed, much to the general satisfaction.

Newcastle-on-Tyne.—The Tramways Committee has agreed to a scheme for utilising the sand cars during the winter for distributing coal in the city.

South Africa.—The application of electric traction to certain sections of the S.A. railways has been raised on several occasions in recent years. Mr. John Roberts, the borough electrical engineer of Durban, considers that a great field lies before electricity on the Natal main line, and he looks forward to a time at which large power plants will be established in various parts of South Africa from which the railways will draw their supply. According to this authority, the Durban-Johannesburg line must

inevitably be electrified in the near future, and the supply of current will, of course, be a most essential part of the scheme. The Natal line to Johannesburg is 480 miles in length. Assuming current available at Johannesburg and Durban, a third supply about midway would fall, by a fortunate chance, right in the principal Natal coalfield. To ensure continuity in case of breakdown, two more stations would be required, one midway between Johannesburg and Newcastle and the other between Newcastle and Durban. —*British S.A. Export Gazette.*

Walsall.—YEAR'S WORKING.—During the year ended March 31st last, the Corporation tramways carried 10,395,050 passengers and operated over 900,000 car-miles. The revenue amounted to £52,373 (roughly 1s. 2d. per car-mile); working expenses were £30,004 (7·9d. per car-mile, including 2d. for electricity); and after meeting interest and loan charges, there was a net balance of £11,170. Of this, £5,000 went in rate relief and £3,146 to special reserve, &c. The 'buses operated in connection with this undertaking earned 14d. per mile; the operating expenses were 10¼d. per mile (including 3¼d. per mile for petrol); and after meeting financial charges, a balance of 2·6d. per 'bus mile (£3,146) was carried to the appropriation account.

TELEGRAPH and TELEPHONE NOTES.

Russia.—Owing to the opening of the Russian offensive the All-Russian Radio-Telegraphic Congress has been postponed.

Telephonic Reception of Cable Messages.—It appears that the telephone receiver may take the place of the Kelvin siphon recorder in the reception of cable messages at no distant date. Recently a number of experiments were carried out under the direction of Lieut.-Colonel G. O. Squier, in which the receiving apparatus made use of the "ticker" principle and the audion, both of which figure prominently in the wireless apparatus of to-day. The cable used for the test was 1,086 miles long, and the actual receiver was an ordinary telephone. The feeble current received was broken up by means of the sliding contact "ticker" and rendered audible, and in order to secure greater sensibility, a tuned audion amplifier was used in connection with the "ticker." It is reported that the sensitiveness of the apparatus is so great that less than one-twentieth of the voltage necessary for operating the siphon recorder is sufficient to give good traffic signals.—*Telephone Engineer.*

CONTRACTS OPEN and CLOSED.

OPEN.

Aldershot.—July 17th. E.L. installation at Cargate House, for the U.D.C. Mr. F. Garside, Electrical Engineer.

Australia.—SYDNEY.—August 22nd. N.S.W. Government Railways and Tramways. Thirty-six induction motors (Specification No. 488). September 19th.—One 225-H.P. synchronous motor (Specification No. 489). Particulars from Electrical Engineer's Office, 61, Hunter Street, Sydney.

Dublin.—July 16th. Electricity Supply Committee. Transformers for one year. See "Official Notices" July 6th.

Glasgow.—Electricity Department. Boiler-house plant. E.H.T. switchgear (20,000 volts). See "Official Notices" June 15th.

Hull.—July 19th. T.C. Machinery oils for the electricity works and sub-stations. Mr. J. F. Magoris, Acting Electrical Engineer.

Keighley.—August 3rd. 12,000 tons best slack and small slack coal for Electricity Department. Six-monthly and twelve-monthly period. Mr. H. Webber, Boro' Electrical Engineer.

London.—ISLINGTON.—July 19th. B. of G. Supply and fitting of complete X-ray apparatus. See "Official Notices" to-day.

Spain.—The municipal authorities of Fuentesauco (Province of Zamora) have recently invited tenders for the concession for the electric lighting of the town during a period of 20 years.

West Ham.—July 17th. Corporation. Two motor ambulance vehicles. See "Official Notices" July 6th.

CLOSED.

Aldershot.—U.D.C. Setting up electrically-equipped chaff-cutting machinery: Burch & Vertue, £42.

Bridlington.—T.C. 1,000 tons of Bullcroft Main washed small coal for the electricity works: W. P. Wilson, York, 19s. 9d. per ton.

Buxton.—T.C. 2,000 tons of Pilsley hard slack coal for the electricity works: Day & Ferguson.

Dartford.—U.D.C. 2,000 tons of Aberclwyd rough small coal free on rail at Dartford, for the electricity works, at £1 4s. 6d. per ton.

Derby.—T.C. 100 illuminated route-number indicators for the tramways: General Seating Co., Ltd., £250.

Dewsbury.—Council. Electric vehicle (£911), Messrs. Mossay & Co.

Halifax.—Guardians. Mr. C. J. Casse, Bradford, at £29, electric wiring of Craigie Lea.

Hull.—Electricity Committee. Mr. Con. Greenwood, at £2,195, for cooling water tower foundations for the electricity works extension.

Sheffield.—City Council. Accepted tenders:—
T. W. Ward, Ltd.; M. C. Burnby & Son; George Turner; Longbottom and Co.—32,000 tons of coal for 12 months, for Kelham Island power station.
Longbottom & Co.—208,000 tons of coal for Neepsend.
Jonathan Longbotham & Sons.—375 tons per month, from July, 1917, to June, 1918, of Bentley wash smalls, for Neepsend.
R. White & Sons.—Extension of contract for relaying the crane track on the coal-storage ground at Neepsend, £229.
George Cooper.—Steel chimney.

Sunderland.—T.C. Electricity Committee. Redpath, Brown & Co., rolled-steel joists.

Wolverhampton.—Council. Accepted tender:—
Melville Dundas & Whitsun.—Construction of new boiler-house wing, including overhead coal-bunkers, foundations and skeleton structure for the boilers, economisers, &c., £5,936.

FORTHCOMING EVENTS.

Birmingham and District Electric Club.—Saturday, July 14th. Visit, in conjunction with the Association of Mining Electrical Engineers, Warwickshire and Staffordshire Branch, to the Walsall Corporation generating station at Birchills. Paper will be read by Mr. H. A. Howie on "Recent Extensions to the Walsall Electricity Undertaking."

NOTES.

Useful Wrinkles.—In the course of certain experiments, Mr. Harry W. Brown, of Ballycarry, Co. Antrim, has discovered that upon charging a condenser from a 500-volt circuit, and then discharging it through the primary of a spark coil, he is able to get good sparking effects from the secondary terminals. The idea may not be new, but he has not yet seen it described in any text-books. He has also found an interesting method of making the calculation of the combined resistance of two circuits in parallel more amenable to the slide rule by using the following formula:—

$$R = \frac{R_1}{1 + R_1/R_2}$$

where R_1 and R_2 are the resistances of the two parallel circuits and R is their combined resistance. This also may not be new, but is certainly more convenient than the usual form.

Volunteer Notes.—COUNTY OF LONDON VOLUNTEER ENGINEERS (FIELD COMPANIES).—Headquarters, Balderton Street, Oxford Street, W.

Orders for the week, by Lieut.-Colonel C. B. Clay, V.D., commanding:—
Monday, July 16th.—Technical instruction for No. 3 Company, Right Half Company, at Regency Street. Drill, No. 3 Company, Left Half Company. Signalling Class. Recruits' Drill, 6.30.
Tuesday, July 17th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30.
Wednesday, July 18th.—Drill, No. 1 Company, Left Half Company.
Thursday, July 19th.—Drill, No. 2 Company, Left Half Company. Ambulance Class, 6.30. Signalling Class.
Friday, July 20th.—Technical instruction for No. 3 Company, Left Half Company, at Regency Street. Drill, No. 3 Company, Right Half Company. Recruits' Drill, 6.30.
Saturday, July 21st.—N.C.O.'s Parade, 2.0. Map Reading.
Sunday, July 22nd.—Parade will be at Esher for engineering instruction.

MACLEOD YEARSLEY, *Adjutant.*

Women's Work Exhibition.—An exhibition of official technical photographs and samples of women's work in the engineering and allied industries connected with munitions of war was opened on Monday last at the City Art Gallery by the Lord Mayor of Leeds. It will contain examples of the very latest developments in the employment of women in these industries; its object is to demonstrate the extent to which women have been and can be employed upon responsible work of all kinds. It will remain open until July 21st.

Standardisation in Electricity Supply in France.—In view of the large amounts of hydro-electric power now employed for war purposes, which will be set free on the return of peace, and the scarcity of coal, a Lyons correspondent of the *Revue Générale de l'Électricité* points out the importance of adopting uniform practice in the construction of new power stations, in order to facilitate their interconnection, and enable them to transmit power to distances of several hundred kilometres. Seven or eight generating stations situated on different rivers would thus be able jointly to supply some 200,000 H.P. at 150,000 volts in the region of Paris, thereby saving large quantities of coal.

Municipalities and Electricity Problems.—Reporting upon the Board of Trade Committee on Electricity Supply, the Council of the Association of Municipal Corporations makes the subjoined interesting observations on the Electric Lighting Acts and Orders, with suggestions for reform :—

The section of the Act of 1888, giving to the local authority a provisional veto, was, in our opinion, a useful enactment at that time, but we think it is not suitable to the new conditions already referred to, and we recommend the Association to assent to a reasonable modification of the terms of that section.

The provision giving local authorities the power of purchase also calls for consideration as affecting the position of local authorities supplying energy outside their municipal boundaries. Where this has been authorised, the purchase by an outside local authority of the part of the undertaking in its area would undo the work done in the way of reducing the cost of supply through increased and diverse demand, and consumers throughout the whole area would suffer in consequence. We suggest, therefore, that it should be no longer obligatory to apply to undertakings authorised by provisional orders the provisions of the Electric Lighting Act, 1888, as to purchase. Where, however, rights of purchase already exist we do not think that there should be any interference with them, except upon agreed terms.

A less important provision relating to the promotion of Provisional Orders is contained in Sec. 4 (1) of the Electric Lighting Act, 1882, which requires notice of the intended application to be given to the local authority on or before the first day of July in the year in which the application is made. This was amended by Sec. 9 of the Electric Lighting Act, 1909, by enabling the local authority to waive its right to receive the notice. These provisions have no doubt been useful in the past, but, on the other hand, the necessity to give the notice, unless waived, is liable to cause the loss of a year in obtaining statutory powers, and constitutes, therefore, a hindrance to the extended supply of electricity, and we accordingly recommend that the provisions should be repealed.

Another step to be taken to ensure a cheaper supply of electricity would be to encourage and facilitate the linking-up of two or more generating stations in neighbouring areas, thereby making more economical use of their plant and allowing some of the stations to be closed at times when the demand is reduced, and in some cases to close down stations which, by reason of the general alteration of areas of supply, linking-up, and other economical considerations, have become unnecessary. The adoption of this course in any particular case must necessarily depend upon the circumstances and upon the terms that can be arranged.

Suggestions have been put forward from time to time with reference to uniting in one department the functions now performed by various Government Departments in connection with electrical matters. The department primarily concerned in the supply of electricity is the Board of Trade, who make the Provisional Orders, and who under those Orders and the Electric Lighting Acts have numerous duties to perform. The authority for sanctioning loans for electricity purposes is, however, the Local Government Board, and the Home Office have certain powers in connection with the use of electricity in factories and some other matters. Some advantage would, no doubt, be derived from uniting these several powers in the hands of one department, but we are doubtful whether the scheme would prove altogether practicable, and we further think that the disadvantages attaching to the setting-up of any fresh Government Department would outweigh any advantages there may be ; it would, however, be well to strengthen the technical side of the Board of Trade. If any changes are made in regard to Government Departments on this subject, we trust that nothing will be done to relieve them of their responsibility to Parliament.

Board of Trade Committee on Electric Supply.—In connection with the above, at the last meeting of the Bristol Electrical Committee, the following resolutions were passed :—

"That this Committee are surprised and disappointed that the I.M.E.A. has not been invited to nominate a member for the Board of Trade Committee, and further resolves that the Board of Trade be again requested to appoint one or two members recommended by the I.M.E.A. on the Committee, so that the technical side of the municipal case can be adequately represented.

"That the chairman and Mr. Senington, and the engineer and general manager be requested to interview members of Parliament on the matter."

The Bradford Electricity Committee has received a letter from the Hammersmith B.C. intimating that its Electricity Committee felt that all Electricity Committees should combine for the purpose of demanding that the Board of Trade Committee as at present constituted should be dissolved, and that a new Committee consisting of a small number of competent, unbiased persons, not directly interested in electrical matters, should be constituted in lieu thereof.

It was decided fully to endorse and support the action taken by Hammersmith.

Scottish Electricians' Wages.—Sir Richard Lodge, Edinburgh, arbiter in a difference between the Electrical Contractors' Association of Scotland and the Electrical Trades Union, has issued the following award, dated June 25th :—

The workers concerned in the employ of firms in the Electrical Contractors' Association shall receive the war advances granted by the Committee on Production to the shipbuilding trades on March 1st last, on the terms laid down in the Committee's award. Payment of these war advances shall be on and from the first full pay day of the current month. I grant no change in the payments for country money, in the assurance that employers will make allowance whenever extra expenditure is involved on a country job.—*Glasgow Herald.*

Institution and Lecture Notes.—Canadian Electrical Association.—The twenty-seventh annual meeting of the Canadian Electrical Association, the first convention of this kind since the European war began, was held at Montreal on June 7th and 8th. It was very well attended, particularly by engineers and executives of systems in the Eastern Provinces of Canada, and was most encouraging in retrospect and prospect. Mr. D. H. McDougall, of the Toronto Power Co., who was recently elected vice-president of the National Electric Light Association, was re-elected president of the Association. In his address President McDougall outlined the difficulties imposed on the Canadian companies by the war, and said the industry had passed through, perhaps, the most eventful year since the founding of the first central-station company in 1884. The demands for energy had in most cases been abnormal, owing to munition manufacture, and to the fact that Canada herself was prosperous, but all the conditions had been met by the companies for the most part, in spite of the inroads on operating and commercial staffs, and difficulties of financing and of securing fuel. Both in Montreal and in Toronto about 35 per cent. of the normal number of men employed have enlisted.

Mr. Julian C. Smith, chief engineer and vice-president of the Shawinigan Water and Power Co., Montreal, read a paper showing the enormous use made of electricity since 1870, and presented the following list showing the KW.-hours used per capita as supplied by the electric service companies in the United States and Canada for all purposes except railways :—

	KW.-hours per capita.		KW.-hours per capita.
Shawinigan Falls, Que.	41,000	Minneapolis ...	450
Niagara Falls, N.Y. ...	33,000	Cleveland	400
Three Rivers, Quebec ...	3,400	Boston	350
Montreal...	700	Philadelphia ...	250
Toronto	700	New York	225
Buffalo	585	Quebec	200
Pittsburg	500	Newark	180
Rochester	450		

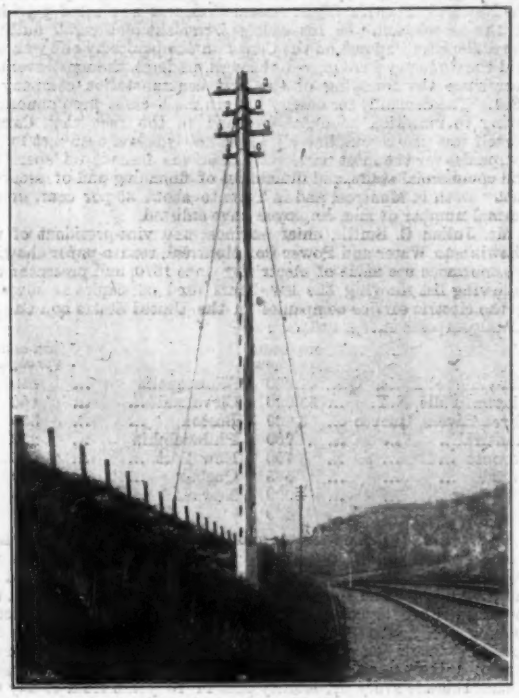
To-day in the United States and Canada, in those places where normal industrial life exists, the KW.-hours used per annum per capita amount to about 500, of which 400 KW.-hours are used for factory purposes and 100 KW.-hours for household uses. With the increased use of small accessories and the development of electric cooking Mr. Smith predicted that the use of electricity in the household would increase 300 per cent. within the next five or six years. At the same time, the industrial use is bound to increase, so that there is every probability that in 10 years from to-day the use of electrical energy will be twice what it is at the present time. —*Electrical World.*

Society for Electrical Development.—The results of the $1,250 prize contest, conducted by the Society in connection with the nation-wide house-wiring campaign, April 1st to May 15th, has been announced. The Society offered 35 prizes, ranging in value from $150 to $10, to employés of member companies in cities of five classes, from under 15,000 inhabitants to 500,000 and over. For contest purposes, the definition of a contract was construed as "a signed agreement with a new customer for wiring at least three rooms with four sockets or over, in a house already built, located along existing lines, and requiring no other than ordinary service connection." In two classes there were two winners of the seventh prize. The 37 prize winners wired 2,663 houses, an average of 72 houses each, or an average of two houses during each working day during the six weeks of the contest, and connected up 1,813 KW., an average of 49 KW. each. Salesmen not eligible for entrance in the campaign contracted for wiring over 10,000 houses.

Electric Smelting of Titaniferous Iron Ores.—Prof. Albert Stansfield, McGill University, has recently prepared an article for the Canadian Department of Mines dealing with a big magnetite deposit in Quebec. According to the *Financial Times*, he states that on the north shore of the Saguenay River, Province of Quebec, is a deposit of titaniferous magnetite estimated to contain from 1,000,000 to 5,000,000 tons of ore. Electric power may be obtained at two points on the river—9 miles west and 12 miles east of the deposit. Charcoal and limestone, necessary for electric smelting, are conveniently situated. The ore contains approximately 50·53 per cent. Fe, 10·55 Ti, 0·02 S, 0·03 P, and is susceptible to magnetic separation, yielding a concentrate containing approximately 56·20 per cent. Fe and 8·3 Ti, by which it will be seen that either crude or concentrated, a titaniferous magnetite must be treated. It is stated that 1·75 tons of concentrates treated in an electric furnace such as is used in Sweden would, with the addition of 0·4 ton charcoal and 0·5 ton limestone, produce 1 ton of pig iron. The electrical power required would be approximately 3,000 KW.-hours per ton of metal produced. To smelt the original ore 0·4 ton of charcoal and 0·7 ton of limestone or dolomite would be required and about 3,500 KW.-hours per ton of pig iron would be consumed. Assuming a plant to consist of three furnaces of 4,000 H.P. each and the output to be 80 tons per day, the total cost of pig iron would be about $21, and it would be marketable as an exceptionally high-grade iron.

Electric Heating and Cooking.—Under this title we published on June 1st part of a paper purporting to be read by Mr. C. Scott before the Birmingham and District Electric Club. The paper, we find, was read by Mr. R. Weaving before the club on February 13th, 1915, while the paper read on May 12th, 1917, was one by Mr. E. K. Scott, entitled "Electric Furnaces for Nitrates from the Air." We regret the mishap, due to a contributor's error and tender our apologies to Mr. Weaving.

The Marriott Concrete Pole.—The accompanying illustration shows a 30-ft. triangular hollow telegraph pole, constructed of reinforced concrete on the system patented by Mr. W. Marriott, of Melton Constable. Many such poles have been erected on British railway lines, which also use the system for signal posts, gate posts, girders, sleepers, and other purposes. The manufacturers and licensees are Messrs. John Ellis & Sons, Ltd., of Leicester, and



Marriott Telegraph Pole.

Mr. W. Jones, of 154-5, Upper Thames Street, E.C., is sales agent. It is claimed that with the Marriott system of reinforcement, posts, &c., can be so designed as to weigh little more than double as much as wood, with greater strength, and that the work is not only cheap—in some cases cheaper than wood—but also practically everlasting.

The British Westinghouse Changes.—Commenting on the sale of the American holding in the British Westinghouse Co., the New York *Electrical World* says :—

"A powerful financial group in London, through the control of the British Westinghouse Co., the French Westinghouse Co., and the Italian Westinghouse Co. are said to have further plans which will rival the great German company, the Allgemeine Electricitäts Gesellschaft. It is significant that the American Westinghouse Co. not only retains a financial interest in this combination, but that the sale of its shares is based upon and made in connection with an agreement of alliance with the London group under which the American company trades in the Western Hemisphere and the Far East, including Asiatic Russia, and the British company in Europe, Africa, and Australia, each company representing the other as sole agent in its respective territory for business that naturally gravitates towards the other. This is especially interesting as it is the first great Allied business combination that has been announced since the beginning of the war, and marks another important development in the affairs of the Westinghouse Co.

Fatalities.—An inquest was held at Bolton, last week, on George Edward Hosler (32), who was employed at the Corporation electricity works cleaning a switchboard, when he caught hold of a live wire by mistake, and was killed. A verdict of "Accidental death" was returned, and the jury recommended that cubicles containing live wires should be locked, so as to prevent any future accident.

An inquest was held at Dudley, on Friday, concerning the death of W. H. Dudley, aged 29, who met with fatal injuries while following his employment at the Electric & Ordnance Accessories Co., Saltley, Birmingham. He was engaged on a circular saw, cutting timber, when a piece of the wood flew back and struck him in the abdomen, causing a rupture of the intestines. The saw was driven by a 7½-H.P. motor. Verdict, "Accidental death."

Irish Peat and Electrical Power.—Strong representations are being made to the Government for the appointment of an expert in electrical engineering on the Committee set up by the Department of Scientific and Industrial Research to inquire into Irish peat resources, and, as peat is such an important factor in electrical development, it is being urged that there should also be some connecting link between the Committee and that appointed by the Board of Trade to inquire into the question of electrical power for industrial purposes. Sir John Griffiths, of Dublin, is chairman of the Irish Committee.

Educational.—Board of Education.—The transfer of the offices of the Board of Education to a part of the premises of the Victoria and Albert Museum took place during the first week in July. As from July 9th, the official address of the Board will be at the Victoria and Albert Museum, Exhibition Road, South Kensington, London, S.W. 7. The official telephone number will be Western 804. The main entrance door to the offices for persons having official business with the Board will be the door in Exhibition Road, hitherto used as the western entrance to the Museum. The President, the Parliamentary Secretary, the Permanent Secretary, the Permanent Secretary of the Welsh Department, and the Chief Medical Officer will continue to occupy rooms in the Board's present offices in Whitehall. Personal letters to them may be addressed to Whitehall. Telephone number, Victoria 6,082.

University College, London.—The new chemical laboratories at University College have been designed to meet the requirements of modern chemical teaching and research, including provision for physical chemistry, in which branch immediate and rapid progress is urgent. The cost of the site, building, and equipment will be £120,000; £100,000 has already been raised, and Sir Ralph C. Forster, who has already subscribed generously to the cost of the laboratories, has promised £5,000 on condition that the remaining £15,000 is raised speedily. Subscriptions may be sent to Lord Glenconner at the College.

Appointment Vacant.—The Liverpool Education Committee wants a lecturer in electrical engineering (£250) for the Central Municipal Technical School.

Some Uses of Magnetic Separators.—The use of a series of magnets of different strengths makes it possible to separate materials having different magnetic permeabilities and also to separate magnetic from non-magnetic ores or concentrates. In treating monazite sands, magnetite is removed by the weakest magnet, ilmenite by the intermediate, and monazite by the strongest. The non-magnetic material passes away, giving three concentrated products. Magnetic separators of the multiple-pole type have found application in the dressing of zinc ores. Marmatite, a ferruginous sphalerite, is slightly magnetic, and is separated from the raw pyrite by the most powerful magnet. Non-magnetic zinc-iron sulphide ores require a slight roast to make the pyrite magnetic, and the separation of these two constituents is accomplished by low-strength magnets. Franklinite, fowlerite, and garnets are separated from willemite, zincite, quartz, mica, and calcite by means of such machines.

Magnetic separation seems to be in use in several tungsten camps in the United States. It is absolutely essential that the concentrates obtained from tungsten mills be high grade and uniform in composition. The magnetic tungsten minerals, wolframite, huebnerite, and ferberite, lend themselves particularly well to treatment by the magnetic separator, according to some authorities. In the wet concentration of tungsten ores, the heavy sulphides of iron, lead, zinc, &c., as well as the heavy oxides of tin, magnetic iron, arsenical sulphides, carbonate of lead, garnets, and other impurities pass off the tables and contaminate the tungsten concentrates. The multipolar magnetic separator completely eliminates these detrimental minerals. Again, there is no market for a mixed product of tungsten and tin, or for wolframite and scheelite mixed, as each of these minerals requires a different method for the extraction of the tungstic acid. By passing the combined wolframite-scheelite concentrates over the magnetic separator, the wolframite is removed by the magnets, while the non-magnetic scheelite passes off at the end of the machine.

Magnetic separation is also possible for the following: the separation of pyrrhotite from other sulphides, garnet, or gangue; of roasted chalcopyrite from garnet and epidote; of roasted chalcopyrite from iron or nickel sulphides; of magnetite from weakly magnetic minerals; roasted limonite from smithsonite and calamine; pyrolusite from quartz gangue; leucite from lava; magnetite from corundum; magnetite, menaccanite, chromite, and pyrrhotite from diamond-bearing concentrates; magnetic galena (probably iron-bearing) from zinc ore and gangue; and, finally, hematite from gangue minerals.—*Metallurgical and Chemical Engineering.*

Additions to the B.E.A.M.A. Membership.—The B.E.A.M.A. announces that the following firms have been elected members of the Association :—

Adamson, Daniel & Co., Ltd., Manchester.
Andrews, Cuthbert, London.
Benjamin Electric Ltd., London.
Burnley Ironworks Co., Ltd., Burnley.
Butt, Fredk. R., & Co., Ltd., London.
Cambridge Scientific Instrument Co., Ltd., Cambridge.
Cavendish Elec. Co., Ltd., London.
Coesor, A. C., Ltd., London.
Cox, Harry W., & Co., Ltd., London.
Creed & Co., Ltd., Croydon.
Davey, Paxman & Co., Ltd., London.
Dean, A. E., & Co., London.
Douglas & Grant, Ltd., Kirkcaldy.
Gent & Co., Ltd., Leicester.
Greville, Ernest, London.
Hathorn, Davey & Co., Leeds.
Heenan & Froude, Ltd., Manchester.
Macfarlane Eng. Co., Ltd., Cathcart.
Micanite and Insu., Ltd., London.
Newton & Wright, Ltd., London.
Newtons, Ltd., Taunton.
Pinchin, Johnson & Co., Ltd., London.
Pirelli General Cable Works, Ltd., London.
Reid Bros., Eng., Ltd., London.
Roberts, Wm., & Sons, Ltd., Nelson, Lancs.
Saxon, George, Ltd., Manchester.
Schall & Schall, London.
Small Elec. Motors, Ltd., Beckenham.
Submersible and J. L. Motors, Ltd., Southall.
Urmson & Thompson, Ltd., Oldham.
Wood Bros., Sowerby Bridge.

Auction Sale.—By order of the Controller in the case of the United Machine Tool Co., Ltd., Messrs. Wheatley Kirk, Price and Co. will, on July 25th, offer the stock of 350 lots of new machine tools, also the goodwill of the business, &c., for sale by auction. Particulars will be found in our advertisement pages.

Congress of Civil Engineers.—On the initiative of the Société des Ingénieurs Civils de France, a Committee has been constituted to organise a general congress of civil engineering of the Allied nations. The purpose of the congress will be the scientific, technical, and economic organisation of all industries. The first meeting will take place in November next, and will be of a purely national character; later on, the Allies will be invited to assist at a second session. One of the 10 sections of the programme (Section VI) is entitled "Electricité Industrielle," but almost all are of more or less interest to electrical men.—*Revue Générale de l'Electricité.*

Conference of Electrical Engineers in India.—We have received a copy of the proceedings and report of the second Conference of Electric Inspectors and Electrical Engineers to Government, which was held in Calcutta last December. The volume, which was edited by Mr. J. W. Meares, Electrical Adviser to the Government of India, can be obtained from the Superintendent, Government Printing, Calcutta, price 3s. 7d. The proceedings dealt with questions of law and the interpretation of the Indian Electricity Acts; the Indian Electricity Rules, 1911, including draft rules for electricity in mines; electric inspectors and Government electrical engineers; questions relating to licensees and consumers; matters relating to electric wiring and installations; electrotechnical questions, &c.

In his opening speech the chairman, Mr. J. W. Meares, pointed out that India was in advance of England in respect of wayleaves, as transmission lines there could be run as though they were telegraph lines. The total number of licensed undertakings was only 21, owing mainly to the difficulty of obtaining capital; when it was obtained in the home market promotion expenses were apt to mount up and drown the enterprise with "water." Lately indigenous capital had taken a hand, and the undertakings so financed were paying dividends—but they should see to it that they did not neglect their reserve and depreciation funds. Another difficulty was the scattered character of the area of supply in Indian towns, but this was partly off-set by the domestic fan load, which resulted in exceptionally high load factors. The jerry-wiring trouble was a thorny problem, which needed attention, and the Indian Electricity Rules required amendment.

Draft rules for electricity in mines were approved, and numerous points in connection with the general rules were considered. It was decided that the testing pressure for high-pressure lines and apparatus should be applied for one minute instead of half an hour, and should be twice the maximum working pressure, but in no case less than 2,000 volts; the Electric Inspector could accept the manufacturer's tests as complying with the rule, and where the normal working pressure exceeded 6,600 volts, the test pressure need not exceed the working pressure. It was also agreed that the use of high-pressure motors under 20 H.P. should be prohibited. The rule for wind pressure on overhead lines was considered on the basis of meteorological records, which showed that the maximum pressures recorded varied widely in different areas, and it was resolved that the specified pressures to be provided for should range from 10 lb. per sq. ft. on the plains in the interior, up to 40 lb. in certain exposed coastal districts. It was held that in all new licences the British standard pressures should be adopted, and that steps should be taken with a view to the modification of existing undertakings in the same direction. In connection with contracts, it was resolved that where a contractor proposed to use material of other than British manufacture, the country of origin should be stated in the tender, and that the use of British standards for accessories was desirable. Proposals for licensing contractors and workmen were discussed. The next conference is to be held in Bombay in January, 1918.

Training Disabled Men.—The Leeds Corporation has given permission for disabled soldiers who are being trained for electrical work under the direction of the Local Naval and Military War Pensions, &c., Committee to attend the electricity works for instruction, at the discretion of the manager.

The British Association.—Sir Arthur Evans is to be president of the British Association for another year. Sir Charles Parsons will preside at the meeting which it is hoped to hold at Cardiff next year.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Burnley Tramways Committee recommends that the salary of Mr. Mozley, general manager, be increased from £450 to £525 per annum.

Walthamstow U.D.C. has confirmed the appointment by the electrical engineer of Mr. G. L. Smith as station superintendent, at £175 per annum, rising to £200.

The Heckmondwike D.C. Electricity Committee declined to grant an increase of salary to Mr. Carter, the electrical engineer, under present circumstances, but referred applications for increased wages from the workmen to the Working Committee.

Tunbridge Wells T.C. has granted an honorarium of £50 to the borough electrical engineer, Mr. R. N. Torpy, for services rendered in laying down new plant, &c., without a consulting engineer being engaged.

Mr. W. J. Best, who was appointed on probation in January last, by the Sheffield City Council, as shift engineer at Kelham Island power station, has been transferred to the official staff at £180 per annum.

Walsall Corporation Tramways Committee proposes to increase the salary of the tramways manager by £100 a year.

The Walsall Electricity Supply Committee has placed on record its high appreciation of the valuable services rendered by Mr. T. Llewellyn as clerk of works at the Birchells generating station, and has decided to pay him £25 for his extra services.

Burton-on-Trent T.C. has agreed to Mr. Hall, the electrical engineer, rendering part-time service to assist on the technical side of the Government Coal Distribution Scheme. Mr. Hall was nominated by Mr. Wilson, Technical Adviser to the Controller of Mines, Steam Raisers' Section. Mr. Hall's duties will be to visit the various works in the district selected using coal supplies, and to advise on questions relating to the necessary class and grade of fuel which the firms need to carry on their businesses.

Sheffield Electric Supply Committee has decided that the salary of Mr. H. E. Yerbury (deputy general manager and engineer) be increased from £600 to £700 per annum.

Mr. A. S. Hughes, electrical engineer with the Carron Co., Ltd., Falkirk, was on Monday evening appointed electrical engineer to Falkirk Corporation, at £325 per annum. Mr. Hughes served his apprenticeship with Messrs. Ernest Scott and Mountain, Ltd. Eleven years ago he became electrical engineer at the Carron Iron Works.

Mr. Robert Caven, who for the past 10 years has been manager of the Bessbrook electric tramway, has retired. He has been succeeded by Mr. Robert Hamilton, of Bessbrook.

General.—Mr. J. A. Lycett, general manager of the Black Country tramway systems, is in a new list of Magistrates for Staffordshire.

Mr. Theodore Zettel, of 30, Gloucester Square, Hyde Park, and 67, Queen Victoria Street, London, electrical engineer, has changed his name to Theodore Settle.

Mr. A. W. Makovski, electrical engineer of Reigate, and Mr. J. E. J. Goundry, electrical engineer, of Reigate, have been elected members of the Council of the Reigate and Redhill Chamber of Commerce.

Corporal Yates, East Lancs. R.E., elder son of Mr. Walter Yates, of Messrs. Matthews & Yates, Ltd., has been gazetted second-lieutenant in the R.E.

At Falwood Parish Church, Sheffield, on June 30th, the marriage took place of Mr. W. Medley, electrical engineer, of Wootseats, Sheffield, and Miss Margaret Crofts, Pontefract.

Mr. F. R. C. Rouse, who has been connected with Messrs. Venner and Messrs. Chamberlain & Hookham for some years, and is now a Lieutenant and I.O.M. in the Army Ordnance Department, would be glad if Old Students of the Electrical Department of Finsbury Technical College would in future communicate particulars of their doings, &c., to Mr. J. F. Shipley, 35a, Upton Road, Birkenhead, instead of to himself.

Mr. H. C. Greenwood, M.I.E.E., chief electrical engineer to the Amritsar Municipal Committee, has been called to war service, and is appointed Electrical Garrison Engineer, Lahore Cantt., in the Military Works Department., and was gazetted on May 3rd, 1917.

Messrs. George Schultz & Co., Ltd., electrical insulation manufacturers, &c., announce that their managing director, Mr. Geo. Schultz (though not at any time a German subject), has by Deed Poll changed his name to George Leonard Scott. No change, however, has taken place in the title of the company, which is composed entirely of British subjects.

Roll of Honour.—We regret to see in the list of wounded officers the name of Major B. Ziani de Ferranti, M.C., R.G.A.

We regret to state that Mr. William Wilmot, who was one of Messrs. Falk, Stadelmann & Co.'s country representatives for 15 years, latterly covering more particularly the Manchester district, has died after a few days' illness from pneumonia. He recently joined the R.N.A.S., and was attacked almost immediately with the illness which caused his death. His loss will be keenly felt by his many trade friends.

Private Reginald Claud Whewell, who was employed at the Lancashire Electric Power Co.'s station at Radcliffe, has been awarded the Military Medal for keeping up communications under shell fire. He was awarded the D.C.M. in the Battle of the Somme. He is 21 years of age.

Corporal Edgar Jackson, West Riding Regiment, who was previously an electrician with Messrs. R. F. Winder, Leeds, has been awarded the D.C.M. for gallantry displayed in making raids on enemy trenches and bringing back prisoners early in June. Three months ago he was awarded the Military Medal.

Private L. S. ROE, Tyneside Scottish, who is in hospital at Exeter, wounded, was employed by the Phœnix Dynamo Co., Ltd., Bradford.

Private C. V. WHITEHEAD (21), who before joining the King's Own Royal Lancasters was serving his apprenticeship as an electrical engineer with Messrs. Storey Bros., Ltd., White Cross Mills, Lancaster, is reported to have died of wounds.

Company-Sergeant-Major G. LEWIS, Sherwood Foresters, reported killed, after being missing since September 3rd last, was an employé of Messrs. Fraser & Chalmers, Erith.

Private A. BANNISTER, Sherwood Foresters, presumed killed after being missing since October 31st last, was with Messrs. Whiting & Taylor, electricians, Derby.

The *Times* reports that Second-Lieutenant LEONARD SOLOMON, K.O.S.B., who was killed on April 23rd, aged 32, was educated partly at the City and Guilds Engineering College, at South Kensington. He was in Canada when he joined the Forces, but on medical grounds was discharged. He accordingly underwent an operation, came to England, and got a commission. He was an Associate Member of the I.E.E.

Mr. LAURENCE A. GRIPPER, an official at the Blackburn electricity works, who is now a motor-ambulance driver in the Friends' Ambulance Unit of the British Red Cross, attached to a division of the French Army in France, has had conferred upon him the Croix de Guerre—the equivalent to our D.C.M. He is one of five members of the unit to be thus distinguished for conspicuous bravery in rendering ambulance service to the wounded under heavy shell fire, and the presentation was made by a French General at a parade and march past which was ordered as a special honour to the recipients. All the chief officers present shook hands with them, and the proceedings will be formally communicated to the Commanders-in-Chief of the French Army (General Petain) and the English Army (General Sir Douglas Haig).

Captain G. S. THORNE, R.F.C., who, according to the *Times*, had been missing since March 18th, died of wounds on that day after bringing his machine safely to earth. He was engineer to the Chinese Government power and lighting station at Canton.

Obituary.—ALD. J. MILES.—Ald. John Miles, J.P., the "father" of the Bolton Town Council, died last week at the age of 76 years. For over 40 years he was a member of the Council, and was Mayor in 1901-3. He was Chairman of the Gas Committee when electric lighting was undertaken, and, in addition to laying the foundation-stone of the new electricity works in December, 1893, he switched on the current at the "opening" in the following October. For close on 14 years he was Chairman of the Tramways Committee, and last year was elected Chairman of the Municipal Tramways Association. He was chairman of several companies, including Meters, Ltd., and the Standard Lamp Co., Ltd.

NEW COMPANIES REGISTERED.

C. A. Carpenter, Ltd. (147,868).—Private company. Registered July 3rd. Capital, £4,000 in 3,000 10 per cent. non-cumulative pref. shares of £1 and 20,000 def. shares of 1s. each. To take over the patent rights of C. A. Carpenter connected with burglar and fire alarms, and to carry on the business of electrical and general engineers, &c. The subscribers (each with one pref. share) are: C. A. Carpenter, 38, Brailsford Road, S.W. 2, electrical engineer; A. H. Freeman, 5, Holborn, E.C. 1, secretary. The first directors are to be appointed by the subscribers. Registered office: 79, Gresham Street, E.C.

Grove Engineering & Utilities, Ltd. (147,860).—Private company. Registered July 2nd. Capital £1,500 in £1 shares. Ironfounders, engineers, manufacturers of agricultural implements, electrical engineers, manufacturers and dealers in aeroplane parts, dry-cell battery manufacturers, chemists, druggists, drysalters, manufacturers of and dealers in cases and parts for electric torches, &c. The subscribers (each with one share) are: A. Maber, 29, Croft Road, Merton, S.W. 19, accountant; Miss T. H. Cole, 9, King's Road, Wimbledon, S.W. 19. The first directors are A. Maber and Miss T. H. Cole. Registered office: 196, Merton High Street, Wimbledon.

Fleetway Press, Ltd. (147,853).—Private company. Registered June 30th. Capital, £10,000 in 4,700 pref. and 4,700 ord. shares of £1 each and 12,000 founders' shares of 1s. each. Printers, &c. Agreement with Electrician Printing & Publishing Co., Ltd. The subscribers (each with one share) are: A. Morris, 18, Richmond Avenue, Kingston Road, Merton Park, S.W., printer's manager; A. J. Wilder, 61, Tradescont Road, South Lambeth Road, S.W., accountant. The first directors are to be appointed by the subscribers. Remuneration, as fixed by the company. Solicitors: Biddle, Thorne, Welsford & Gait, 22, Aldermanbury, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Veritys, Ltd.—Mortgage dated June 26th, 1917, to secure £3,850, charged on freehold land, Arrol Works (in the occupation of Jointless Rim, Ltd.), canal basin, &c., at Aston, Birmingham. Holder: G. H. Cartland, Beveré Cottage, near Worcester.

Electrical Contracts & Maintenance Co., Ltd.—Particulars of £3,000 debentures created June 20th, 1917, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

African Direct Telegraph Co., Ltd. (21,895).—Capital, £300,000 in £10 shares. Return dated June 6th, 1917. 23,600 shares taken up; £236,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Marconi International Marine Communication Co., Ltd.

MR. GODFREY ISAACS presided at the annual meeting last week in the absence of Mr. Marconi, who was representing his Government on a Special Commission to the United States. After going over the accounts, Mr. Isaacs said that in view of the fact that their business was still being conducted under exceptionally unfavourable conditions the figures were satisfactory. Practically the whole of their profits were derived from ships' subsidies, for there was practically nothing doing at the present moment in commercial or private telegrams at sea. Normally they derived a very substantial revenue from those telegrams, and when Peace conditions returned they would no doubt see a very substantial increase in receipts from this source. Not only had the number of ship telegraph stations been immensely augmented during the war, but there had been also a large addition to the coast stations, which would give far greater facilities for communication with the land than obtained prior to the outbreak of hostilities. They were making very considerable losses in consequence of the submarine warfare, all of which they were debiting to profit and loss account. It was to be hoped that those losses would cease, and that they would show additional revenue in consequence. They felt justified, having regard to the sound development of the business, to recommend an increased dividend, which they felt confident of being able to at least maintain, notwithstanding the necessity for increasing the capital. Up to June 30th this year they had already fitted 595 additional ships, making the total number of ships installed, after deducting losses, 1,855, which was by far the biggest rate of increase in the history of the company. Orders on hand were very considerable indeed, and they would be very largely increased in the near future. For that they must make provision. After referring to the additions made to the board, the chairman paid a tribute to the staff. To June 16th they had 3,347 operators and students. Of these, to that date 333 had been saved from vessels sunk, 45 were drowned, 29 had been injured, one killed, and 19 had been taken prisoners of war. A number of instances of splendid heroism were given by the speaker. One man had been torpedoed three times within three months, standing to his post unflinchingly on each occasion; they had now given him a post on shores, because if his nerves had not suffered they ought to have done so.

General Electric Co., Ltd.

The net profits for the year ended March, 1917, were £265,220, plus £48,053 brought forward, making £313,273. After deducting debenture interest and normal and special depreciation amounting to £38,541, £274,732 is available, and it is appropriated as follows:—6 per cent. preference dividend, £42,000; employés and managing director's bonus, £18,468; 10 per cent. dividend on ordinary shares, free of tax, £62,500; reserve, £40,000; grants to war dependants, £11,477; repayments of income-tax to preference shareholders, £10,500; balance to carry forward (subject to excess profits duty, if any), £89,786. The reserve account has been increased by £100,000 transferred from pre-war suspense accounts of provision for contingencies which have not arisen, and with the addition of the above £40,000, the total amount to the credit of the account will be £400,000. The operations during the year consisted mainly in continuing and developing the policy initiated at the outbreak of the war. The results have again been satisfactory. The works have all been fully occupied, and almost exclusively in the production of material and electrical equipment for war purposes, so that practically the whole of the output normally employed in the supply of the electrical trade has been diverted to meet such purposes and for controlled establishments. About 1,700 members of the staff and workpeople were now serving with the Colours, so that substitution and dilution of labour had become more imperative than ever. Thanks, however, to the loyalty and united efforts on the part of those members of the company's technical and commercial staff whom the authorities had allowed to remain, it had been possible to overcome successfully most of their difficulties. The scarcity of raw material and the difficulty in obtaining machinery, together with the Government restrictions placed upon all building operations, had not enabled the company to proceed with the preparations for the developments awaiting the electrical industry after the war. Capital expenditure during the year on new works of immediate importance had amounted approximately to £15,000, and £11,000 had been expended, under permit from the authorities, to advance the Kingsway building sufficiently to protect the steelwork. The sales organisation at home and abroad had adapted itself well to prevailing conditions, as was evidenced by the year's results. The investment account of the company had again considerably increased, with an eminently satisfactory return. Nearly £300,000 had been invested in the Osram-Robertson Lamp Works, Ltd.; a further £50,000 had been required by the Pirelli-General Cable Works, Ltd.; and certain smaller sums had been invested in minor factories essential for the production of material for the company's requirements. The Pirelli-General Cable Works, in which the company was largely interested, had this year—the second year of its existence—

shown satisfactory results. All the allied and subsidiary companies continued to do well, with the exception of one or two which had been adversely affected by conditions of war. During the year Mr. Fred S. Sells retired from the board.

Annual meeting: July 17th.

We give below the comparable figures from the reports for the three years ended March, 1915, 1916, and 1917:—

	1915.	1916.	1917.
Net trading profit and income from investments	£164,877	£196,275	£265,220
Depreciation and debenture interest	26,855	27,260	38,541
Pref. dividend	38,681 (6 %)	42,000 (6 %)*	42,000 (6 %)*
Available balance	136,081	163,716	274,732
Managing director's and employés' bonus	9,934	12,701	18,468
War grants	7,482	12,962	11,477
Ordinary dividend	48,142 (10 %)	50,000 (10 %)	62,500 (10 %) (free of tax)
To reserve account	20,000	40,000	40,000
Balance carried forward ...	36,701	48,053	89,786
Reserve fund total	220,000	260,000	400,000

* A resolution is to be brought before the annual meeting authorising the payment of a special bonus at December, 1917, to the then registered holders of preference shares, the sum payable to be equal in amount to the total income-tax deducted from the dividends paid in respect of the said shares on December 31st, 1916, and June 30th, 1917.

Edmundsons' Electricity Corporation, Ltd.

The net profit for the year ended March, 1917, after providing for mortgage and debenture interest and redemption, and for £1,165 additional income-tax, amounts to £12,294, as against £13,259 last year. Adding £4,625 brought forward, the total profit available is £16,918, out of which £12,000 is required for dividend on the preference shares, and £4,919 is to be carried forward. We extract the following figures from the schedule, showing gross profits of subsidiary and other companies for the years 1915 and 1916:—

	Gross profit (before providing for capital charges and depreciation). 1916.	1915.	Load connected in kw. 1916.	1915.
Alderley	£3,813	£3,060	1,133	1,092
Bromley	9,125	11,007	4,499	4,254
Folkestone	17,189	17,064	5,212	5,064
Guernsey	5,208	5,707	5,004	4,850
Isle of Wight	8,971	10,403	5,403	5,096
Ilfracombe	502	816	771	741
Lancashire Co. ..	39,839	32,842	22,828	21,634
Lymington	949	1,488	741	730
Melton Mowbray ..	1,763	2,475	904	883
Newmarket	1,624	1,970	1,051	1,035
North of Scotland ..	7,550	7,008	3,503	3,391
Ramsgate	2,732	3,075	1,499	1,499
Scarboro' Trams ..	—1,068	—1,729	—	—
Salisbury	4,885	6,670	1,686	1,545
Urban Co.'	67,713	70,001	33,886	30,376
Wycombe	5,748	6,881	2,021	2,392
Cromer	110	308	620	609
Dorking	1,982	2,603	988	980
Frome	2,076	1,405	1,942	1,777
Hamilton	4,883	4,528	2,882	2,799
Barbiton	2,877	*2,309	1,852	1,726
	£187,441	£190,208	99,095	92,423

* Nine months.

The Lancashire Co.'s figures are included for the first time. The total capital expenditure increased during 1916 from £3,826,409 to £3,854,931.

The Paris Metropolitan Railway.

The report of the *Compagnie du Chemin de Fer Metropolitian de Paris* for 1916 first gives the customary details concerning the works carried out by the City of Paris on the one hand, and by the company on the other. After mentioning that the terminal trunk Opera-Palais Royal No. 7 line was opened on July 1st, the report states that the average length of the network was 48½ miles, of which two miles were worked by the company for the account of the City. The service and the working of the trains were further improved in the measure which was compatible with the difficulties incidental to the maintenance of the rolling stock and the necessity to spare it. At the end of 1916 the rolling stock comprised 703 motor cars, 270 first-class trailers, and 335 trailers for second-class passengers. A beginning was made in 1915 in the direction of providing the doors of the second-class carriages with electro-pneumatic pushers, which permitted of the doors being automatically closed from a distance. This measure was generalised in 1916, and was extended to the end doors of the first-class carriages. In addition, no seats had been provided in a certain number of compartments in some of the second-class carriages for the use of passengers with bulky parcels.

The accounts show total receipts from passenger traffic and sundry receipts amounting to £2,311,000, the working expenses having been £1,089,000. The ratio of working expenses to receipts was 47.14 per cent., as compared with 43.69 per cent. in 1915. After deducting the share paid to the City out of the gross revenue according to the terms of the concession—£755,000, as contrasted with £596,000 in 1915—and after meeting the interest charges on the loan capital of £5,000,000, the accounts show net profits of £271,000, which has permitted of the declaration of a dividend at the rate of 5.6 per cent. on the ordinary share capital of £3,000,000, leaving £56,000 to be carried forward. The report also deals with the difficulties arising from the scarcity and dearness of raw and other materials, and states that the coal bill alone increased by £240,000 in 1916 as compared with a normal year. Under the circumstances, the directors had approached the City of Paris, whose share in the profits had largely increased, with a view to securing a revision of the concession contract, so that one of the parties should not have to incur all the risks and the other obtain larger profits due to unforeseen circumstances. At the same time permission is being sought to raise first-class fares, so as to defray the cost of war increases already granted to the company's servants.

Swiss Companies.

The Société Paul Girod, of Neuenburg, earned gross profits of £418,000 in 1916, as compared with £143,000 in the previous year, the net profits being £231,000 and £57,000 in the two years respectively. It is proposed to pay a dividend of 10 per cent., as against 8 per cent. in 1915. The company is to be amalgamated with the Aciéries Girod, of Ugine, France, by means of an interchange of shares.

The Motor A.G. fur Angewandte Elektrizitat, of Baden, which owns electricity supply works, and is interested in others, reports that the demand experienced by these works in 1916 was exceptionally active, although it was impossible to raise prices in proportion to the growth in the cost of production. It was to be assumed that constructional work in regard to new undertakings would be brisk after the war, especially in those countries which were largely dependent upon imports of coal, and which would develop their water power resources. The accounts show net profits of £90,000, as compared with £89,000 in 1915, and a dividend at the rate of 7 per cent. is proposed on the ordinary share capital of £1,200,000, being the same as in each of the four preceding years.

The Société Franco-Suisse pour l'Industrie Electrique, of Geneva, which is an investment company, reports that no occasion arose in 1916 for embarking upon new business, but various subsidiary companies experienced considerable development in which the company participated within the limits of its funds. The losses on the rate of exchange, which was again seriously felt, had been equalised by the higher quotations which prevailed for a number of securities as contrasted with 1915. The receipts from interest, dividends, and other investments reached £75,000, as against £74,000 in the previous year. After defraying general expenses and meeting interest on the loan capital of £879,000, the accounts show net profits, including £4,000 transferred from the special reserve fund, amounting to £44,000, as compared with £11,000 in 1915. It is intended to pay a dividend of 4 per cent. on the share capital of £1,000,000, this contrasting with no distribution in 1915 and 1914, and 5½ per cent. in 1913.

Electric & General Investment Co., Ltd.—Mr. J. B. BRAITHWAITE, presiding at the annual meeting of the company last week, said, according to the *Times*, that since the outbreak of the war the ordinary financial business out of which the company usually made its living had been almost non-existent. They had therefore simply to conserve their resources and quietly await the return of peace. Instead of paying a dividend, the board considered it better to strengthen the company's financial resources.

Chile Telephone Co., Ltd.—During the year ended at March, 1917, the subscribers increased by 936 to 14,24[illegible]. The total length of lines in operation increased by 1,379 miles. The gross revenue advanced by £30,209 to £152,182, and the total expenditure (exclusive of income-tax) by £26,674 to £92,597. The net revenue was £59,584, an improvement of £3,535. Dividend already paid 3s. per share, free of tax; a final dividend of 5s. per share is now recommended; £16,386 is put to reserve, and £2,000 to reserve against loss on investments, carrying forward £5,202.

Havana Electric Railway, Light & Power Co.—The accounts for 1916 show a net profit of $2,421,291, as compared with $2,236,257, and an available sum, including $1,709,956 brought forward, of $4,131,248, out of which dividends amounting to 6 per cent. on the common shares have been paid, as compared with 5½ per cent. for the previous year, and after transferring $75,000 to reserve for depreciation, and $123,083 to reserve for bad and doubtful debts and other adjustments, $2,024,501 remained to be carried forward.—*Financial Times.*

Dublin United Tramways (1896), Ltd.—Interim dividend, 4 per cent. per annum (4s. per share), less tax, on ordinary shares.

Sao Paulo Tramway, Light & Power Co., Ltd.—Dividend of 2½ per cent. on the issued common stock.

Direct United States Cable Co., Ltd.—Interim dividend, 2s. per share, less tax, for the quarter ended June.

Fraser & Chalmers, Ltd.—Interim dividend of 7½ per cent. on the preference shares, less tax.

Winnipeg Electric Railway Co.—There is a decrease of $35,742 in net income, and no dividend is recommended for 1916.

Dublin United (Electric) Tramways, Ltd.—Interim dividends, 6 per cent. per annum, less income-tax, on the preference shares, and 4 per cent. per annum, less income-tax, on the ordinary shares.

STOCKS AND SHARES.

TUESDAY EVENING.

AERIAL, rather than financial, interest has been a feature in Stock Exchange markets this week, although it is surprising how very quickly London settles down to its accustomed grooves as soon as immediate danger is past. Brisk business has been done in aircraft policies—brisker than that, in fact, which has characterised the market in stock and shares. At the same time, the strength of the latter is extremely well maintained; and the way in which the prices of Consols, the War Loan, and other gilt-edged securities keep up constitutes something of a standing marvel to those who preach a forthcoming War Loan and, as a sequel, further depreciation of values.

Home Railway stocks continue to make an extremely good showing; and there has been a little more inquiry for some of the home electrical shares. Amongst telegraphs, West Coast of America shares are once again better; while in the group of cable manufacturing concerns, the scarcity of shares remains the outstanding feature.

The Home Railway market is one of the best in the House. At first, the demand centred upon the stocks of the trade lines, but the improvement quickly spread to others, and the Undergrounds were included in the all-round firmness. Underground income bonds have risen to 83½, Metropolitans to 24½, and Districts to 16½. The near approach of the half-yearly dividend payments is held responsible for the renewed attention that has caused the rises in prices. Holders of the stocks naturally do not want to sell at this particular season of the year, so that it takes very little demand to produce an effect which in reality is exaggerated.

West India and Panama shares have risen to 28s. 9d., and, amongst the heavier cable stocks, Eastern ordinary is good at 140½. The rest of the list is distinctly strong. Attention is being called in the market to the shares of the Marconi Marine Co. as being cheap and holding possibilities of early improvement. Maybe the prophets will turn out right, because the present price of 47s. 6d. includes the dividend recently declared, and, judging from the statements made at the meeting at the end of last week, the Marine Co. is doing extremely well. In the shares of the parent undertaking there is little going on, and apparently the recent operators intend to see what the Government is really going to do before they—the buyers—venture further into the market.

Oriental Telephones are ½ up at 2½, which seems a remarkably high price, considering the extremely trifling yield afforded at that level. The company's last report was a good one, and showed that amounts equal to about 20 per cent. had been placed to various reserves, so obviously anticipation is looking for an increase in the next dividend. Still, the probable advance is certainly discounted in the present figure. Of the manufacturing shares, Callenders are 5s. better at 13½, and Henleys are 10s. up at 16, both of them being difficult to get sold of. Castner-Kellners eased off to 3 5/16.

There is not much doing amongst home electricity shares. The feature continues to be the strength of the London varieties. Cities at 12½ and Counties at 10½ are both half-a-crown higher on the week, and Counties changed hands within the last day or two as high as 10¾. South Metropolitan preference drooped to their par price of £1, the return being, therefore, 7 per cent. on the money. Having regard to the appetite which has sprung up just lately for sound preference shares in the industrial market, South Metropolitan preference do not look dear.

The General Electric Co. aroused considerable interest with its dividend announcement at the rate of 10 per cent. on the ordinary shares, free of tax, at the same time recommending the repayment to the preference shareholders of the income-tax for two half-years. The question immediately arose as to whether this latter action was not *ultra vires*, but it was taken for granted that the directors were fully armed with the necessary powers to carry out the recommendation—otherwise they would hardly have made it.

The company's gross profit for the year ended March 31st last came to £265,220, an increase of nearly £70,000 over that of the previous twelvemonth. The reserve fund is strengthened by £100,000, making it £400,000 altogether; and £89,876 goes forward, against £48,000 brought into the accounts. Upon this, the price of the ordinary shares rose to 16 and the preference to 10, these prices being somewhat nominal, inasmuch as there are very few shares to be obtained. The preference bonus is a substantial one, but the directors announce that it is in respect of one year only.

Armament shares keep good, though some irregularity has developed in the iron and steel group as a whole. Amongst rubber shares, there was a fall upon the refusal of the Chancellor of the Exchequer to modify the incidence of the excess profits duty, though subsequently the list rallied upon a re-reading of the speech and appreciation of the fact that the Chancellor did not entirely close the door upon some possibility of relief being afforded. The base-metal list is steady, the strength of the commodities helping to keep prices good.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price July 10, 1917.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	9	6¼	—	£5 18 6
Charing Cross Ordinary	5	5	8¼	—	7 2 10
do. do. do. 4½ Pref.	4½	4½	5⅞	—	6 18 6
Chelsea	4	3	3¾	—	5 4 4
City of London	8	8	12⅝	+ ⅛	6 12 0
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10⅝	+ ⅛	6 10 3
do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	10	6½	—	5 11 7
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	8⅝	—	5 6 8
Metropolitan	8	8	14	—	6 0 0
do. 4½ per cent. Pref.	4½	4½	8xd	—	7 10 0
St. James' and Pall Mall	6	6	6½	—	6 3 1
South London	5	5	3⅞	—	7 5 6
South Metropolitan Pref.	7	7	20/-	-1/-	7 0 0
Westminster Ordinary	7	7	6¾	—	6 1 9
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98	—	6 2 0
do. Def.	23/6	1½	22⅝	—	6 16 4
Chile Telephone	8	8	7	—	5 14 4
Cuba Sub. Ord.	5	5	6¾	—	5 17 8
Eastern Extension	8	8	13⅜	—	*5 16 6
Eastern Tel. Ord.	8	8	14	+1	*5 14 0
Globe Tel. and T. Ord.	7	7	13⅜	—	*5 9 10
do. Pref.	6	6	10½	—	5 17 1
Great Northern Tel.	22	24	36	—	6 13 4
Indo-European	13	13	51	—	6 7 5
Marconi	10	10	9½	— ⅛	5 1 6
New York Tel. 4½	4½	4½	99	—	4 11 0
Oriental Telephone Ord.	10	10	2⅞	+ ⅛	3 12 9
United R. Plate Tel.	8	8	6⅝	—	*5 18 6
West India and Pan.	6d.	6d.	1/16	+ 1/16	1 14 9
Western Telegraph	8	8	14	—	*5 14 4
HOME RAILS.					
Central London, Ord. Assented	4	4	80½	—	6 8 0
Metropolitan	1	1	24½	+ ½	4 2 6
do. District	Nil	Nil	16½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1½	—	Nil
do. do. "A"	Nil	Nil	5/9	—	Nil
do. do. Income	6	5	83½	+ 1	*5 10 9
FOREIGN TRAMS, &c.	Dividend 1915.	Dividend 1916.			
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	34½	—	7 16 6
do. 2nd Pref.	5½	—	2½	—	—
do. 5 Deb.	5	5	68½	—	7-6 0
Brazil Tractions	4	4	48	— ½	—
Bombay Electric Pref.	6	6	10	—	6 0 0
British Columbia Elec. Rly. Pfce.	5	5	67½	—	6 13 10
do. do. Preferred	Nil	Nil	8¾	—	Nil
do. do. Deferred	Nil	Nil	27½	—	Nil
do. do. Deb.	4½	4½	57½	—	7 8 6
Mexico Trams 5 per cent. Bonds	Nil	Nil	37	—	Nil
do. 6 per cent. Bonds	Nil	Nil	50	—	Nil
Mexican Light Common	Nil	Nil	14½	—	Nil
do. Pref.	Nil	Nil	23½	—	Nil
do. 1st Bonds	Nil	Nil	89½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	9	—	5 0 0
British Aluminium Ord.	7	10	28/9	—	6 19 2
British Insulated Ord.	17½	20	12⅝	—	7 15 0
British Westinghouse Pref.	7½	7½	2⅜	—	6 6 4
Callenders	20	20	13½	+ ½	7 8 2
do. 5 Pref.	5	5	4½	+ ⅛	5 17 8
Castner-Kellner	22	22	8-5/16	—	6 10 2
Edison Swan, £8 paid	—	—	16/3	—	Nil
do. do. fully paid	—	—	1⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	70½	—	5 13 6
Electric Construction	7½	7½	⅜	—	8 0 0
Gen. Elec. Pref.	6	6	10	—	6 0 0
do. Ord.	10	10	16	—	6 5 0
Henley	25	25	16	—	7 16 8
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	12½	—	*8 5 0
Telegraph Con	20	20	87½	—	*6 8 2

*Dividends paid free of income-tax.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bristol (Trams)	June 29	22,848	+3,907	26	283,304	+18,863	30·5	..
Cork	„ 28	2,584	+ 382	26	13,108	+ 692	9·89	..
Dublin	„ 29	29,359	+2,846	26	168,976	+19,599	54·25	..
Hastings	„ 24	5,442	+1,421	25	25,606	+ 4,289	19·2	..
Lancashire United	„ 27	10,791	+3,985	26	53,073	+ 8,924	42	..
Llandudno-Col. Bay	„ 29	1,519	— 235	304	7,246	— 618	6·5	..
Anglo-Argentine	July 1	204,470	+13,568	26	1,327,059	+11,000	..	..
Auckland	June 1	21,742	+ 890	48	258,101	+ 6,043	26·29	..
Calcutta	„ 30	17,511	+ 91	..	..	+ 1,317	..	..
Kalgoorlie, W.A.	March	2,772	+ 228	13	7,896	+ 483	20·5	..
Madras	June 30	4,209	+ 840	26	27,227	+ 2,588	..	..
Montevideo	June	27,458	+2,158	25	242,796	+ 1,728	..	..
Dublin-Lucan Rly.	June 15	806	+ 148	24	3,464	+ 236	7	..

ELECTRICAL WORK IN THE TROPICS.

[COMMUNICATED.]

The white man in the Tropics very seldom does any manual work. It is true that, owing to the advances of medical and engineering science, life in such regions is much more healthy for the European than it used to be. Where the sun's rays are vertical, however, the manual labour of the world is, and should be, done by the native. The European adjusts himself to new conditions, and, whether it is because he finds the climatic conditions enervating, or whether it is that he wishes to maintain the white man's prestige, the fact remains that he seldom, if ever, does manual work in the Tropics.

Unfortunately, the climatic conditions of that belt of the earth's surface which lies near to the Equator are especially bad for all electrical apparatus. The atmosphere is usually saturated with moisture. The degree of humidity is almost unbelievable. Often the walls inside the buildings have water running down them, and it is, of course, quite impossible to have wall papers for decorating the interior of houses. In many parts of the Tropics granite is found, and great masses of rock or stone act as condensers. They cool at night, and in the early morning, when the sun heats the air, the atmosphere deposits its moisture when it is brought against the comparatively cool surface of the stone. This humidity affects clothing; a pair of boots which look normal at sundown will grow a peculiar greenish-blue covering before sunrise.

From these few remarks it will be seen that the electrical engineer in the Tropics has much to try him. Nothing could be worse for insulation than such a climate. Nothing is worse for the nerves than the joint effect of climate and native indolence. For the races which inhabit the equatorial regions are most exasperating, when they are employed in industrial work. Nature has so richly endowed mankind in the Tropics that, until the restless energy of the white man sought to reduce chaos to order, the inhabitants had no incentive to work. The fecundity of the animal and vegetable world is so great that food is obtainable with but little exertion, while there is no need to provide clothing.

The New Conditions.—The earth is changing rapidly, and the native of the Tropics is being lifted up out of his state of indolence and savagery by the new civilisation. The world is so small, that the fighting on the battle fields of Europe will determine the methods by which the economic development of the Tropics will take place. The German method of dealing with natives was brutal. It is not racial conceit to state that no nation has more successfully developed tropical regions than the British. The secret of our success has been honest administration and the stimulus of great rewards to all men who would show enterprise. An example of what is possible for any man to do, irrespective of colour, is furnished by the case of the late Mr. Loke Yeow, C.M.G. The Chinese who became a British subject, and died a sterling millionaire, left his native village, near Canton, in China, a penniless coolie. He went South to the tropical regions of the Malay States, and, by dint of industry and the opportunities given to him by a generous system of government, he amassed a fortune.

Machinery is needed in the Tropics, and as cultivation of the agricultural products is intensified and the mines are developed, more and more electrical apparatus will be needed. Efforts are being made to train the young generation of natives, and technical education will certainly stimulate a demand for machinery. But the technical education should be for the non-commissioned officers; Europeans will always direct and take the initiative. It is folly to expect the native of, say, Java, to become suddenly intelligent enough to become a captain of industry. Such human material has its limitations, and that fact must be recognised.

The Technical Difficulties.—There are all sorts of engineering problems to be solved in the Tropics which never occur in temperate climates. There should be some inducement offered to electrical engineers in such regions to place on record, their experiences. Take the simple case of storage batteries. The humidity of the atmosphere affects them, and there are other difficulties. It may be that some special design of battery is necessary. It may be that most of the troubles one hears about are almost entirely due to neglect and ignorance. (If the white man is inexperienced, the native will certainly encourage neglect.) It may be that temperature conditions affect the plates. It may be that all would be well if pure water were used. Whatever the reasons, the fact remains that storage batteries have a bad reputation in the Tropics. Let us obtain some definite data as to their life and actual working behaviour in such a climate. The writer has not had sufficient experience to offer anything except suggestions. It does seem to be either a fact, or a superstition, that storage batteries should be worked at below their rated capacities when they are used in the Tropics. If it is a fact, perhaps there is a known reason.

The white people near the Equator demand the new conditions of life. They expect electric light and the priceless boon of the electric fan. They will demand electric motors for ice plants in the near future. Telephones, and even electrically driven carpet-sweepers, are among the first inquiries of the bride out from home. The market for one type of electrical apparatus, the fan, must be enormous; the demand must run almost into millions per annum, and the demand increases each year.

The problem which awaits the Allied nations as soon as peace is concluded is the systematic exploitation of the vast resources which Nature has placed in the Tropics. In that great work of reducing chaos to order the electrical engineer will play a prominent part. Those who have had experience in the Tropics should be encouraged to place on record the methods by which they have overcome the many difficulties which beset them.

ELECTRIC STEEL FURNACES.

With Special Reference to the Greaves-Etchells Type.

By E. KILBURN SCOTT, A.M.Inst.C.E., M.I.E.E.

Since the war, one of the most striking developments of the steel industry of Great Britain has been the rapid increase in number of electric steel furnaces; so successful have they been that the prejudice against this type of furnace is rapidly disappearing, and the change will probably rank as the most radical one since the time of Bessemer.

Amongst factors which have helped to bring the electric furnace into favour are the war demand for special tool steel for tools, dies, gauges, &c.; the demand for chrome and other special alloy steels for aircraft tubing, rustless steel, &c.; the difficulty in obtaining Swedish iron, which, besides being scarce, is extremely expensive; the difficulty in obtaining skilled labour to work the crucible steel process; the necessity of profitably using turnings, millings, ends of tubes, bars, and other scrap steel; and the ease with which high-class steel can be made from second-grade materials in electric furnaces.

Certain electric supply authorities, as, for example, those at Sheffield, Newcastle, Rotherham, and Luton, have done much to encourage electric furnace loads by reducing charges for energy, and by moderating the requirements as regards power factor, the unbalancing of phases, &c. The foresight of the city electrical engineer at Sheffield is especially commendable in preparing for an electric furnace load.

For the manufacture of high quality steel castings the electric furnace is ideal. The superiority of electric steel castings over those made by any other process has been conclusively proved by the extremely severe conditions to which these castings have been subjected under specialised war conditions. The castings produced can be finished off dead mild, and a 1-in. square bar can be bent double as cast, no expensive annealing operations being necessary. The carbon contents usually vary between .2 per cent. and .25 per cent., while the sulphur and phosphorus are each reduced below .015 per cent., and manganese and silicon are adjusted to suit the work.

The tensile properties of ordinary electric cast steel are:—

Maximum tensile strength ... ... 35 tons per sq. in.
Yield point ... ... 25 tons per sq. in.
Reduction of area, 50 per cent. Elongation, 30 per cent.

The maximum tensile stress can be readily increased to even 100 tons per sq. in. by the introduction of special elements, such as nickel, chromium, and vanadium.

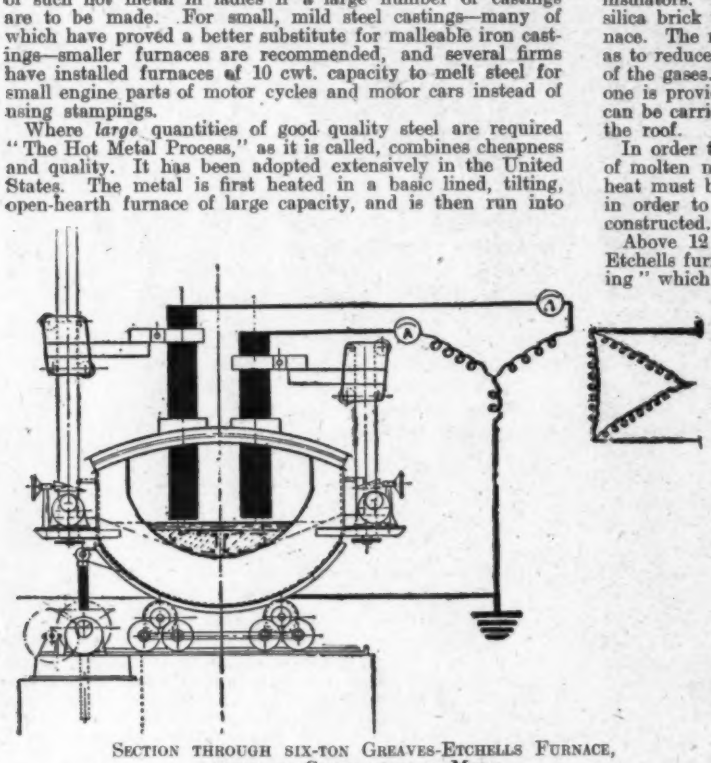
Many works that sell their steel swarf and scrap, cast-iron borings, &c., at very nominal prices, and purchase all their steel castings, could very profitably install an electric furnace and make their own castings from the scrap. The charge can be made up entirely of scrap and turnings; no expensive

raw materials are necessary. The melting loss is almost negligible, while in other processes it is from 7 per cent. to 15 per cent.

Steel from the electric furnace is finished off under a reducing atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced, and is singularly free from blowholes when properly cast. This is due to the elimination of the gases that molten steel usually holds in solution, and the ease with which the steel can be poured into small and intricate moulds, flowing smoothly like milk, and setting perfectly quietly, is largely due to its purity.

For small, light castings furnaces of not more than 30 cwt. are recommended; steel of such low carbon content has a high melting point, and must be cast at a very high temperature, and though the temperature is easily obtainable in the furnace, difficulties occur in handling large quantities of such hot metal in ladles if a large number of castings are to be made. For small, mild steel castings—many of which have proved a better substitute for malleable iron castings—smaller furnaces are recommended, and several firms have installed furnaces of 10 cwt. capacity to melt steel for small engine parts of motor cycles and motor cars instead of using stampings.

Where *large* quantities of good quality steel are required "The Hot Metal Process," as it is called, combines cheapness and quality. It has been adopted extensively in the United States. The metal is first heated in a basic lined, tilting, open-hearth furnace of large capacity, and is then run into



Section through six-ton Greaves-Etchells Furnace, showing Circulation of Metal.

a number of electric furnaces for final refining and addition of alloys. The process is continuous, and as the energy for the first melting of the steel is obtained direct from fuel, the amount of electrical energy is only that required to maintain the temperature during refining and the assimilating of the alloys. Steel so produced commands high prices.

Electric furnaces are used for the melting of ferro alloys for open-hearth and Bessemer plants, as it is found much more economical to make alloy additions in the *molten* form. The electric furnace is ideal for this.

Types of Furnaces.

As the earlier furnaces were for small outputs, single-phase alternating current was used, and to obtain a balance on a polyphase supply several furnaces had to be worked together.

Polyphase furnaces are better than single-phase furnaces, because for a given output of steel one such furnace is cheaper, takes up less room, and requires less attention than several single-phase furnaces. With single phase, if one arc fails the circuit is broken, and the load falls to zero. This is liable to happen during the melting-down period, when the pieces of scrap metal change position under the electrodes.

Some arc furnaces have all the electrodes above the bath of metal, one of this class being the *Heroult*. As arranged for three-phase supply it has three vertical electrodes through the roof, and the arcs are between each electrode and the bath, so that the molten metal forms part of the electrical circuit. Two furnaces, namely the *Girod* and the *Snyder*, employ water-cooled steel studs, which pass right through the bottom or hearth. As the ends of the studs project into the metal of the charge they burn away, and have to be renewed at intervals. This form is also not good practice, because of the danger of the metal finding its way through the hearth, and the liability of trouble with water connections. It will be noted that in all the above-named furnaces the refractory material of the hearth does not require to carry current. The material may be, therefore, either acid (silica) or basic (magnesite).

The furnaces mentioned below have also bottom electrodes, but come under a different category because the hearth itself conducts electric current. It is, therefore, made of magnesite material, as this, when heated, is a fairly good conductor. A furnace of this class is that of Electro-Metals, Ltd., which was invented by Gronwall. It works with two phases, and has two electrodes above the bath, whilst a third electrode below the hearth acts as a common neutral for the two phases.

Another furnace which has met with considerable success is that of Greaves-Etchells, more than 30 having been installed or put under construction since January, 1916. This is an all-British production, both in inception and manufacture.* It is designed to operate on a three (or two) phase supply, and has two of the phases connected to electrodes above the bath, the third phase being connected to a copper plate below the electrically conductive hearth of magnesite.

The roof is made of silica bricks, as these are fairly good insulators. They are set in a steel framing which rests on the silica brick walls projecting above the steel body of the furnace. The roof is domed and brought as low as possible, so as to reduce the wasting away of the electrodes by the action of the gases. A roof will last about 100 heats, and a duplicate one is provided with each furnace, so that the steel melting can be carried on, except for the short time taken to change the roof.

In order to obtain an even temperature through the bath of molten metal in the electric furnace, it was realised that heat must be applied below, as well as above, the bath, and in order to effect this the hearth of the furnace is specially constructed.

Above 12 per cent. of the total energy of the Greaves-Etchells furnace is used in the hearth, and the "bottom heating" which results is found to be of great advantage in melting down alloys. The heavier alloys—chrome, tungsten, vanadium, and nickel—sink to the bottom of the bath, and if there is no bottom heating are apt to remain for a considerable time in a semi-fluid state.

The hearth lining is never less than 20 in. thick, and is constructed mainly of dolomite and magnesite, in such a manner that the electrical resistance is high at the inside of the bath in proximity to the charge, and decreases rapidly to a negligible quantity at the outside. The current flowing through the hearth generates a considerable amount of heat immediately below the liquid in the most efficient manner possible, while the electric arcs arranged over the bath maintain the slag and surface at the desired temperature.

The effect of this bottom heating is to cause convection currents in the molten metal, which ensure a constant circulation, and a uniform product. The outside of the furnace bottom remains cold, little or no heat being lost in this direction.

This system of connection at first sight would appear to cause an out-of-balance load on the primary supply, but the system of transformer ratios is arranged to give a perfect balance when the upper electrodes are in equal adjustment.

The Greaves-Etchells system of transformer connections is such that the short-circuit current of one electrode must traverse two transformers in series and in different phase, which automatically lowers the power factor momentarily, and has a very strong buffer effect; the fact that there is always a permanent resistance in the path of the current through the hearth also limits very considerably the effects of short circuits. The combination of these factors provides the most effective means yet devised for protecting the supply system from shock, while allowing a high power factor to be obtained on normal load.

For the manufacture of high-speed steels or special alloy steels, a ¼-ton or 1¼-ton furnace is usually adopted, and the former can finish a charge from cold material and alloys in two to two and a half hours, with an energy consumption of 400 units.

To make up a charge from scrap, it is usual to place steel turnings and millings on the hearth, then pieces of bar and rail ends, tube ends, and finally large pieces of steel. The interstices between the large pieces are filled with turnings, &c., and some iron ore may be added. The amount of iron ore depends on the amount of iron oxide present in the form of rust on the scrap.

As the charge is melted, a slag of lime and fluorspar is made in order to eliminate the phosphorus as phosphate of lime. After this phosphate slag has been skimmed off, a new slag is made of best Buxton lime, fluorspar, and white sand in the proportions of 30, 10, and 5. When this has fluxed, a small quantity of finely powdered anthracite coal is spread on the slag, and this is continued until the slag is deoxidised.

The steel is thus finished off under an atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced. When entirely deoxidised a sample of slag falls to a fine white powder as it cools. Deoxidisation of the slag results in deoxidisation of the steel, through the constant reduction of silicon from the slag, and it may be hastened by addition of small quantities of ferro-silicon.

* The Greaves-Etchells furnace was described, with illustrations, in the Electrical Review, April 13th, 1917.

As a comparison with the crucible steel process, it may safely be stated that a 10-cwt. electric furnace running a charge every two and a half hours, or, say, nine charges per day, will do as much as 36 crucible furnace holes each having two 56-lb. pots.

The electric furnace is operated by one skilled man, one unskilled man, and one ammeter boy, whereas the crucibles require 15 men, most of whom are skilled, or, at any rate, classed as indispensable. At two Sheffield works, girls are employed to regulate the electrodes.

Such an electric furnace, with its transformers and switchgear, will occupy about a quarter of the space occupied by the crucible plant, and the initial cost of the electric furnace will be about half that of the crucible plant.

The charge of the electric furnace can be made entirely from turnings, millings, &c., whereas in the crucible steel process only a very limited quantity of turnings, &c., can be used.

Owing to the low heat efficiency and high cost of labour, crucible steel is much more expensive to manufacture. The cost of renewing crucibles is considerably higher than the renewal of an electric furnace for the same output. Already several steel works have shut down their crucible plant after installing electric furnaces.

The introduction of the Bessemer and open-hearth processes of making steel left crucible steel makers indifferent owing to the fact that these methods were employed for making ordinary kinds of steel in great quantity for structures, rails, &c. The coming of the electric furnace is a different proposition, as it competes directly and successfully in the special field that the crucible steel process has held so long.

The crucible steel process has been largely responsible for great waste of the nation's resources by reason of the coke being made in beehive ovens, this quality of coke being necessary for the crucible steel process. The introduction of the electric furnace should help to stop this waste in the future.

In conclusion, it may be mentioned that very soon there will be 50 electric furnaces at work in the Sheffield district, and the output of steel from them will be at the rate of over 200,000 tons per annum.

In the United States over 100 electric furnaces are already at work, and a single electric steel plant is being erected in South Chicago which will give an output of 200,000 tons per annum.

In view of the rapidly increasing demand for high-grade steels, makers cannot afford to be second-best, and electric furnaces offer the only certain method of obtaining and holding the market.

TRADE STATISTICS OF INDIA.

The following figures of the imports of electrical and similar goods into British India in the year ended March 31st, 1916, are taken from the recently-issued official trade statistics; details for the year ended March 31st, 1915, are added for purposes of comparison, and notes of any increases or decreases are given:—

	1914-15. £	1915-16. £	Inc. or dec. £
Brass, wrought.—			
From Great Britain ...	31,000	46,000	+ 15,000
,, Germany	2,000	—	– 2,000
,, Italy	4,000	—	– 4,000
,, Other countries ...	30,000	72,000*	+ 42,000
Total	67,000	118,000	+ 51,000
* Japan £42,000.			
Copper and copper ware.—			
From Great Britain ...	950,000	309,000	– 641,000
,, Germany	487,000	45,000	– 442,000
,, Belgium	12,000	10,000	– 2,000
,, France	126,000	7,000	– 119,000
,, Austria	2,000	—	– 2,000
,, Japan	254,000	108,000	– 146,000
,, Other countries ...	18,000	15,000	– 3,000
Total	1,849,000	494,000	– 1,355,000
Iron wire.—			
From Great Britain ...	82,000	140,000	+ 58,000
,, Germany	19,000	1,000	– 18,000
,, Belgium	7,000	1,000	– 6,000
,, United States ...	26,000	71,000	+ 45,000
,, Other countries ...	5,000	1,000	– 4,000
Total	139,000	214,000	+ 75,000
Prime movers, other than locomotives.—			
From Great Britain ...	428,000	268,000	– 160,000
,, Germany	1,000	—	– 1,000
,, United States ...	10,000	14,000	+ 4,000
,, Other countries ...	8,000	5,000	– 3,000
Total	447,000	287,000	– 160,000
Electrical generators.—			
From Great Britain ...	14,000	8,000	– 6,000
,, Other countries ...	1,000*	7,000†	+ 6,000
Total	15,000	15,000	—
*Belgium £1,000. †Italy £6,500.			
Electrical motors.—			
From Great Britain ...	74,000	50,000	– 24,000
,, Germany	1,000	—	– 1,000
,, United States ...	1,000	2,000	+ 1,000
,, Other countries ...	3,000*	2,000	– 1,000
Total	79,000	54,000	– 25,000
* Italy £2,000.			
Other electrical machinery.—			
From Great Britain ...	243,000	129,000	– 114,000
,, Germany	6,000	—	– 6,000
,, Italy	4,000	9,000	+ 5,000
,, United States ...	6,000	10,000	+ 4,000
,, Other countries ...	1,000	2,000*	+ 1,000
Total	260,000	150,000	– 110,000
* Switzerland £1,000.			
Mining machinery.—			
From Great Britain ...	49,000	63,000	+ 14,000
,, Switzerland ...	—	9,000	+ 9,000
,, United States ...	48,000	58,000	+ 10,000
,, Other countries ...	1,000	2,000	+ 1,000
Total	98,000	132,000	+ 34,000
Machinery, other (except textile, agricultural, and printing).—			
From Great Britain ...	563,000	387,000	– 176,000
,, Germany	22,000	1,000	– 21,000
,, Italy	—	3,000	+ 3,000
,, United States ...	34,000	30,000	– 4,000
,, Other countries ...	17,000	13,000	– 4,000
Total	636,000	434,000	– 202,000
Electric fans.—			
From Great Britain ...	28,000	19,000	– 9,000
,, Italy	10,000	26,000	+ 16,000
,, United States ...	13,000	25,000	+ 12,000
,, Germany	2,000	—	– 2,000
,, Other countries ...	2,000	—	– 2,000
Total	55,000	70,000	+ 15,000
Electric lamps and parts.—			
From Great Britain ...	24,000	40,000	+ 16,000
,, Germany	3,000	—	– 3,000
,, Austria	2,000	—	– 2,000
,, Japan	—	1,000	+ 1,000
,, United States ...	—	4,000	+ 4,000
,, Other countries ...	2,000	9,000*	+ 7,000
Total	31,000	54,000	+ 23,000
* Holland £7,000.			
Electric wires and cables.—			
From Great Britain ...	149,000	145,000	– 4,000
,, Germany	2,000	—	– 2,000
,, Japan	—	2,000	+ 2,000
,, United States ...	1,000	2,000	+ 1,000
,, Other countries ...	1,000	2,000*	+ 1,000
Total	153,000	151,000	– 2,000
* Italy £1,000.			
Other electrical instruments, apparatus, &c. (except telegraph and telephone materials).—			
From Great Britain ...	290,000	257,000	– 33,000
,, Germany	7,000	—	– 7,000
,, Japan	—	7,000	+ 7,000
,, Austria	1,000	—	– 1,000
,, United States ...	19,000	20,000	+ 1,000
,, Other countries ...	6,000	12,000*	+ 6,000
Total	323,000	296,000	– 27,000
* Holland £6,000.			
Scientific, &c., instruments.—			
From Great Britain ...	63,000	48,000	– 15,000
,, Germany	2,000	—	– 2,000
,, United States ...	1,000	7,000	+ 6,000
,, Other countries ...	3,000	9,000*	+ 6,000
Total	69,000	64,000	– 5,000
* France £4,000.			
Telegraph construction materials.—			
From Great Britain ...	18,000	10,000	– 8,000

	1914-15. £	1915-16. £	Inc. or dec. £
Machinery.—			
From Great Britain ...	212,000	127,000	– 85,000
,, United States ...	—	1,500	+ 1,500
,, Other countries ...	1,000	500	– 500
Total	213,000	129,000	– 84,000
Telephone construction materials.—			
From Great Britain ...	17,000	18,000	+ 1,000
,, Sweden	—	3,000	+ 3,000
,, Other countries ...	—	1,000	+ 1,000
Total	17,000	22,000	+ 5,000

In addition to the foregoing, the following were imported as Government stores:—

Instruments, apparatus, &c. (except musical).—			
From Great Britain ...	181,000	171,000	+ 10,000
,, Other countries ...	2,000	1,000	– 1,000
Total	183,000	172,000	– 11,000
Iron wire.—			
From Great Britain ...	10,000	16,000	+ 6,000
Telegraph construction materials.—			
From Great Britain ...	102,000	80,000	– 22,000
Copper and copperware.—			
From Great Britain ...	113,000	128,000	+ 15,000
,, Other countries ...	78,000	238,000*	+ 160,000
Total	191,000	366,000	+ 175,000

* New South Wales £193,000.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

TRANSIT OF GOODS THROUGH FRANCE.—The Board of Trade are informed that for goods in transit through France to Switzerland which are accompanied by the "pink certificate" issued by the British Customs Authorities, no transport permits are required:—(*a*) When consignments (without limitation as to weight) are sent *vid* Bordeaux, Cette, or Marseilles on Swiss rolling stock; and (*b*) when consignments are sent *vid* other French ports (except Havre) in Swiss trucks, to the amount of one metric ton a day from any one shipper to any one consignee. In all other cases it is necessary to obtain a transport permit from the 4th Bureau of the Ministry of War, in Paris.

PERU.—The Peruvian Customs Bulletin for January 8th contains a Decree dated December 27th, 1916, providing that the duties of 2, 4, and 6 per cent. prescribed by the earlier Decree—referred to in the REVIEW of January 5th last—are to be levied on the market prices of rubber from the Yavari, *i.e.*, the reduction of 30 per cent. from the current prices allowed in respect of rubber from the Madre de Dios is not to be allowed for rubber from the Yavari.

NEW ZEALAND.—An Order-in-Council, dated February 5th, prohibits the importation of electric apparatus known as the Violetta high-frequency generator, and of all accessories specially adapted for use therewith, and of all written or printed advertising matter relating solely or principally to such apparatus.

CANADA.—By a recent decision of the Customs Department, the rates of import duty on electric welded furnaces to be used in the manufacture of boilers for ships or vessels are leviable as follows:—20 per cent. *ad val.* under the Preferential tariff, 27½ per cent. *ad val.* under the Intermediate tariff, and 30 per cent. *ad val.* under the General tariff. [It should be noted that in addition to these duties, a war tax of 5 per cent. *ad val.* is levied under the British Preferential Tariff, and of 7½ per cent. *ad val.* under the Intermediate and General Tariffs.]

FRANCE AND ALGERIA.—A French Ministerial Decree, dated May 12th, amends and amplifies the Decree of April 13th restricting the importation of goods into France and Algeria—see the REVIEW for June 1st. Among the articles added by the new Decree to List No. 3 (*goods the importation of which is placed under the control of the Inter-Ministerial Commission of Woods and Metals*) are:—Frames and carcases of dynamos and of electric motors; armature spiders; covers of electrical collectors; solid poles of dynamos and alternators, of iron or steel, wrought or swaged, of cast iron or steel, of malleable cast iron, of shaped or welded plate.

Applications for French import licences must now be addressed *by the proposed importer in France or Algeria* to the competent authorities in France, the issue of such licences in London having been discontinued. The French Customs Office in London (Bank Buildings, Kingsway, W.C. 2) is prepared to advise exporters as to the classification of their goods for the purposes of the import prohibitions and to give general information on the subject.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

9,073. "Potentiometers, variable resistances, and rheostats." W. E. BARRY. June 25th.

9,086. "Terminal sockets for electrical conductors." ST. HELENS CABLE AND RUBBER CO. & J. C. WHITE. June 25th.

9,108. "Electric signalling devices." J. ATHERTON. June 25th.

9,111. "Electrical condensers for high-tension and high-frequency currents." A. KOWALSKI. June 25th. (Switzerland, June 24th, 1916.)

9,134. "Electrical switches." J. H. COWELL & H. W. COX. June 26th.

9,146. "Trolley heads of electrically-propelled vehicles, &c." A. WOOD. June 26th.

9,153. "Devices for fixing fuse wires to electrical installations." R. A. KERMAN & T. MATHIAS. June 26th.

9,165. "Electro-pneumatic brake system." W. V. TURNER. June 26th. (U.S.A., December 6th, 1916.)

9,182. "Magneto controlling device enabling semi-heavy motors to be started by hand." M. Y. DELAGE. June 26th. (France, July 1st, 1916.)

9,208. "Ignition plugs for internal-combustion engines." W. A. CLARKE, H. G. LONGFORD AND W. W. LONGFORD, & SPHINX MANUFACTURING CO. June 27th.

9,232. "Electrolytic cells for production of chlorine." T. W. S. HUTCHISS. June 27th.

9,239. "Electrical heat raising and lowering apparatus." F. N. PICKETT AND A. WEST, AND A. WEST & CO. June 27th.

9,243. "Electric gun or apparatus for propelling projectiles." A. L. Ó. VILLEPLEE. June 27th. (France, August 5th, 1916.)

9,245. "Electric drive of submarines." SOC. ANON. ITALIANA O. ANSALDO AND CO. June 27th. (Italy, June 27th, 1916.)

9,251. "Electrical advertising device or sign." H. E. GILL & W. E. GRANT. June 27th.

9,267. "Electric generators." V. CRABB. June 28th.

9,287. "Wireless signalling system." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 29th.

9,302. "Spark-plug energiser." W. M. BAUCHELLE & J. D. GRUMMON. June 28th.

9,305. "Ignition dynamos." C. T. MASON. June 28th.

9,308. "Electrical condensers for high-tension and high-frequency currents." A. KOWALSKI. June 28th. (Switzerland, April 13th.)

9,312. "Electro-magnetic lock-out switch." R. P. BOSSON AND A. WEST AND CO. June 28th.

9,330. "Mechanical and electrical horns." E. T. COOK & KLAXON CO., AND J. F. MONNOT. June 28th.

9,331. "Sparking plugs for ignition." K. E. L. GUINNESS. June 28th.

9,335. "Telephone receivers, gramophones, &c." C. T. BUCKELL. June 28th.

9,339. "Terminal-box electrical cable or conductor insulators." R. W. BLADES AND BRITISH INSULATED & HELSBY CABLES, LTD. June 29th.

9,350. "Dynamo-electric machines." J. W. BURLEIGH. June 29th.

9,371. "Electrical telephones." G. M. MASTERS. June 29th.

9,383. "Electrical motor control." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). June 29th.

9,386. "Electrical contact devices." A. H. BAILEY. June 29th.

9,404, 9,405. "Interrupting devices for ignition of internal-combustion engines." R. BOSCH & O. IMRAY (Bosch). June 29th.

9,412. "Apparatus for starting electric motors." N. J. AUSTIN & T. D. TODD. June 29th.

9,450. "Dynamo-electric machines." A. G. A. KAULBACH. June 30th.

9,470. "Electric switches." A. H. MIDGLEY AND VANDERVELL & CO. June 30th.

9,477. "Sparking plug connections." V. PERRETT. June 30th.

9,480. "Protective apparatus for alternating electric current circuits." H. PEARCE. June 30th.

9,482. "Insulated electric conductors or cables." F. JACOB. June 30th.

9,488. "Control of combined engines and electric generators." J. SANKEY AND SONS & W. A. STEVENS. June 30th.

9,489. "Treatment of magnetic material suitable for use in static transformers, &c." A. F. BERRY. June 30th.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

10,672. APPARATUS OF THE DASHPOT TYPE FOR EFFECTING AUTOMATICALLY A DESIRED FUNCTOIN WITHIN A CERTAIN TIME LIMIT. E. A. Fagerland. July 28th. 1916. (106,719.)

11,161. TORPEDO-FIRING CONTROL APPARATUS. W. C. Fairweather (Lake Torpedo Boat Co., U.S.A.). August 8th, 1916. (106,723.)

14,391. ALARM APPARATUS. V. Grima. October 10th, 1916. (106,758.)

14,412. WRAPPERS FOR FRAGILE ARTICLES. British Thomson-Houston Co. (General Electric Co., U.S.A.). October 10th, 1916. (106,759.)

18,245. ILLUMINATED SIGNS. Dingleys, Ltd., & C. W. Hobson. December 20th, 1916. (106,788.)

6,946. HEATING APPARATUS. N. E. Brookes (Good Inventions Co., U.S.A.). May 30th, 1916. (Divided application on 7,645/16.) (106,812.)

3,530. AUTOMATIC TRAIN SIGNAL AND STOP. National Safety Appliance Co. (April 24th, 1915. (100,353.)

8,191. ELECTROMAGNETIC LOCK-OUT SWITCHES OR CONTACT MAKERS. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.). June 9th, 1916. (106,869.)

8,199. ELECTRIC TRUCKS. F. J. Decker. June 9th, 1915. (100,648.)

8,574. ELECTRIC MOTORS FOR SHIP PROPULSION AND OTHER PURPOSES. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 17th, 1916. (106,877.)

9,277. DRIVING AND CONTROLLING DYNAMO-ELECTRIC GENERATORS. W. F. W. Rhodes & J. Firth. July 3rd, 1916. (Addition to 224/16.) (106,886.)

9,742. PORTABLE ELECTRIC LAMPS. F. Westwood. July 11th, 1916. (Cognate application, 11,581/16.) (106,891.)

9,819. FLANGING GLASS TUBES FOR USE IN THE MANUFACTURE OF ELECTRIC LAMPS AND APPARATUS THEREFOR. Morris & Whitham and J. A. Allison. July 12th, 1916. (106,892.)

10,677. CONTROLLERS FOR ELECTRIC MOTORS AND THE LIKE. Electric Control, Ltd., & O. Elliefsen. July 28th, 1916. (106,898.)

12,148. CERTAIN KINDS OF ELECTRICAL SWITCH BOXES. A. E. Read, J. E. Franks & M. Brooks. August 28th, 1916. (106,912.)

15,023. CARRIERS FOR FUSIBLE ELECTRIC CUT-OUTS. Mayor & Coulson and W. Lawrence. October 23rd, 1916. (106,934.)

15,733. METHOD OF AND APPARATUS FOR ELECTRIC HEATING AND TEMPERING. Snead & Co. Ironworks. June 14th, 1916. (106,940.)

17,209. ELECTRIC SWITCHES. H. H. Berry & W. J. Markham. November 30th, 1916. (106,946.)

17,334. TIME-LIMIT ELECTRIC CIRCUIT BREAKERS. Akt. Ges. Brown, Boveri et Cie. January 3rd, 1916. (Addition to 14,498/15.). (103,113.)